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Arctic Science Policy and Development

U.S. MAN AND THE BIOSPHERE PROGRAM

ORIGINAL

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I. Introduction

The International Coordinating Council of UNESCO-Man and the Biosphere Programme (MAB) meeting in Paris in September 1982, accepted a proposal for "establishment of a network for cooperation among peoples engaged in problems peculiar to the circumpolar north." That proposal was incorporated within the existing MAB Project 3, Activities in Marginal Lands. An organizational meeting for the Northern Science Network was subsequently hosted by Canada-MAB in Edmonton, Alberta, in October 1982, with delegates from Canada, Finland, Norway, Sweden, Greenland, United States, and UNESCO-MAB (Paris)[1]. At that meeting it was determined that the UNESCO-MAB Northern Science Network would focus on a pragmatically-defined "north," to include the circumpolar Arctic, adjacent coastal zones, and the taiga and northern boreal forest.

The objectives of the Network are to enhance scientific understanding of the north, and to facilitate improved communication and understanding among scientists, public and private policy makers, resource managers, and resident populations. Toward this goal, three themes were selected for early implementation:

1. *Studies on ecology and land use of sub-arctic birch forests.* These forests form a circumpolar zone extending through Canada, the U.S., U.S.S.R., Finland, Norway, Sweden, and into southwest Greenland and Iceland. Birch forests are important to resident populations for reindeer and domestic sheep grazing, hunting, provision of wood and other forest products, watershed and stream protection, and for tourism. Fennoscandian research stations are already cooperating in birch forest studies, helped by work in experimental gardens and laboratories, and there is potential for circumpolar studies involving North America and the U.S.S.R. This theme is coordinated by Finland-MAB.

2. *Development, monitoring, and research in Biosphere Reserves and other protected areas.* Biosphere Reserves are a major concern of national MAB committees in Canada, Norway, the U.S., and the U.S.S.R.; a major objective of this theme is to encourage development of more reserve areas in the north. This theme includes research and monitoring in many types of reserves including parks, experimental ecological reserves, and watershed research areas. Baseline environmental monitoring, documentation of climatic change, and experimental verification of the consequences of resource extraction and industrial development are appropriate functions of northern reserves. This theme is coordinated by Canada-MAB.

3. *Land use and grazing animals: socio-economic, biological, and environmental effects.* Land-use conflicts occur in much of the circumpolar north, notably between grazing animals (principally reindeer), tourists, and industrial operations such as logging, hydroelectric projects and mining. Improved access into remote areas by new roads and airfields brings often unexpected impacts on environments and societies. Such problems are shared by most northern areas. This theme is coordinated by Sweden-MAB.

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[1] The Soviet Union has been unable to send representatives to Network meetings, but remains on the corresponding list; Iceland applied to join the Northern Science Network in 1984, and the Peoples Republic of China in 1985.

In each theme, an international workshop has been convened to assess status and needs in the respective areas; *Proceedings* from those workshops have been issued or are in preparation.

With the encouragement of UNESCO-MAB, a decision was taken to convene an international meeting to transcend the themes and address a topic relevant to the entire circumpolar north: Science Policy and Development. This topic was considered particularly appropriate in view of increasing attention being paid to development of Arctic policy in Canada, and adoption of the *United States Arctic Research and Policy Act of 1984* (P.L. 98-373).

The UNESCO-MAB International Conference on Arctic Science Policy and Development convened in August 1985, at the University of Alaska, Fairbanks, U.S. An overt attempt was made to involve persons engaged in political as well as scientific aspects of the north, and residents of the north as well as the "visitors" who provide the bulk of northern expertise in policy circles.

Formal sessions dealt with current national perspectives in Arctic research; local (indigenous populations) involvement in formulation and implementation of Arctic science policy; renewable and non-renewable resource development in the context of international and national science; and approaches for facilitating communication and cooperation among high-latitude nations. A pervading theme of the meeting was the circumpolar, shared nature of high-latitude ecosystems, resource development needs, and problems; Arctic haze of European industrial origin was cited as a prime example of poorly understood phenomena with consequences transcending national boundaries. Support was expressed for the concept of long-term environmental monitoring at high latitudes. Increased involvement of local populations in resource development, research, and political processes was of major concern to many participants. The Conference was enlivened by continuing discussions and informal contributions by the participants — a stimulating admixture of the natural and social sciences, resource analysis and management, and political practice. This interdisciplinary, international exchange was perhaps the most rewarding facet of the Conference, even though consensus was not achieved (nor expected) with regard to most topics.

The manuscripts are printed as submitted by the authors, without external review. We hope that the MAB goals of advancing science, education, and understanding man's role in biological systems have been met in some measure through this Conference.

Two contributions at the Conference are not included in these proceedings: Mr. Hermann Steltner, of the Arctic Research Establishment, Pond Inlet, NWT, gave an address entitled "The Human Context in Science in the North" and Dr. Fred Roots, Science Advisor, Environment Canada, Ottawa, provided a masterful and thought-provoking closing address.

We are indebted to many individuals and institutions for contribution of time, talent, and funding. Dr. Bernd von Droste, Director of the Division of Ecological Sciences, UNESCO, provided vital encouragement in organizing the Conference. Financial support was provided by UNESCO-MAB, the United States Man and the Biosphere Program, the North Slope Borough of Alaska, the Government of Alberta, and the Government of the Northwest Territories. Dr. Pat O'Rourke, Chancellor of the University of Alaska-Fairbanks, was a gracious and supportive host at welcoming ceremonies and throughout the Conference. The University of Alaska-Fairbanks, the Office of Conferences and Institutes of UAF, and the University of Alaska Foundation provided essential support services. We are indebted to Ms. Shirleen Smith for editorial and production assistance. Publication of this Proceedings volume was supported by the North Slope Borough of Alaska, the United States Man and the Biosphere Program, and the Arctic Directorate (MAB-6), US-MAB.

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II. International Approaches to Arctic Heritage Use and Conservation

Dr. Bernd von Droste

Arctic international cooperation began more than 100 years ago in 1882-83 when the First International Polar Year resulted in a network of circumpolar stations run by eleven nations to make simultaneous observations over a period of 13 months in a wide range of disciplines, including biology. At that time scientific interest in exploration of an unknown part of our globe prevailed. Since then the world as a whole and the Arctic in particular have changed profoundly. Today the Arctic region is entering a period of greatly accelerated economic, social, strategic and political change. The driving force behind changes taking place is resource development activities. Although the present scale of these activities is not inconsequential, it is small in comparison to their projected growth for the years to come. In short, the Arctic is about to "come alive."

The increasing scale and intensity of human activities are unprecedented in history and threaten the future of the unique natural and cultural heritage of the Arctic. Major preoccupations are, for example, effects of possible climatic changes, the survival of already marginalized human cultures and the risks of major oil spills in Arctic waters. Only today, through major national and international scientific efforts, are we beginning to understand the unique fragile nature of the Arctic natural and social systems, of its natural and cultural heritage, and the key role of the Arctic in worldwide life-supporting processes.

UNESCO is actively involved in both international scientific cooperation in the north and Arctic heritage preservation. These are rather distinct but closely linked activities, for scientific efforts help us to recognize and estimate the worth of the Arctic heritage as well as to identify rational ways and means for its lasting preservation.

Since 1971 the Man and the Biosphere (MAB Programme) of UNESCO has been concerned with building up the scientific knowledge needed for maintaining the natural resources of the biosphere. The MAB Programme deals with the whole range of terrestrial, water and coastal ecosystems from equatorial to polar zones, from littoral to high mountain systems.

However, it was not until 1981 that the launching of the Northern Science Network gave a boost to cooperative MAB research in the north through its focus on the issues of human use of natural renewable resources and the problems that modern economic development is imposing upon indigenous northern cultures.

E.F. Roots recently summarized the rationale for launching a special MAB Northern Science Network by stating: "The northern high-latitude regions are characterized by distinctive physical and biological features and processes but also by distinctive social, cultural, economic and technological features that have many relationships to the natural environment. These distinctive characteristics and relationships, environmental, social, and institutional are to a large degree shared by all northern countries" (Roots 1985).

Therefore, information and research required to address these problems tend to be circumpolar rather than national in scope. In many respects, there is more in common between the scientific, social, and economic aspects of northern regions of different countries than between the northern and southern parts of the same country.

An important task of the MAB Northern Science Network is to provide liaison and information exchange between MAB and other interdisciplinary activities that can contribute to understanding the interaction between the northern environment, its resources, and human needs and activities.

With these considerations in mind three foci were initially selected for the Northern Science Network.

1. Studies on the ecology and land use of subarctic birch forests;

2. Development, research, and monitoring programme in biosphere reserves and other protected areas in northern regions;

3. Socio-economic and environmental effects of land-use practices and grazing animals in the north.

At this time ten countries are associated with these research efforts. A permanent Secretariat headed by Dr. Milton Freeman has been established at the University of Alberta with financial support from the Government of Alberta.

One of the most complex themes which the Northern Science Network coordinates covers land-use practices and grazing animals.

A problem common to all northern countries is the inherent conflict between the needs of large grazing animals, whether herded (reindeer, sheep) or wild (caribou, musk ox) and the activities of other users, particularly industrial (logging, mining, petroleum) or recreational and tourist (winter sports, hunting, and attendant infrastructure). The conflict is for the most part indirect, rather than direct competition for habitat: the animals need to keep moving without undue constraint in order to gather biological energy over a large area, and any activities that interfere with the movement or cause alarm (thereby forcing the animals to use up precious energy) can have serious and lasting effects on herd productivity. The resulting socio-economic repercussions and conflicts between policies, make this theme particularly appropriate for MAB study.

In addition there will be a unique possibility for future comparative studies with grazing systems on arid and semiarid lands currently studied under IPAL, MAB's integrated project on arid lands.

One other major objective of the Northern Science Network is the establishment of a comprehensive Arctic and subarctic biosphere reserve network which, in association with other categories of protected areas, would help to preserve representative ecological areas. Multiple purposes such as *in situ* conservation of genetic resources, preservation of traditional human cultures, environmental research and ecological monitoring could be combined in such biospheric reserves.

I am glad to report that a northern biosphere reserve network is now taking shape. In fact, it already covers vast stretches of land, coastal, and marine areas, but admittedly, its potential for ecological research and monitoring is as yet unrealized. So far, this emerging network comprises seven rather vast areas which together are representative of the diversity of the Arctic natural heritage: Northeast Greenland National Park (70 million hectares), by far the world's largest protected area; Northeast Svalbard National Reserve (1.5 million hectares); Noatak Biosphere Reserve in Alaska (3 million hectares); Aleutian Islands Biosphere Reserve (1.1 million hectares); Denali Biosphere Reserve in Alaska (780,000 hectares); and located in the USSR, Laplandsky Zapovednik (278,000 hectares).

Although this is already an impressive list, major gaps still exist, particularly apparent whenever we consider the vast marine areas of the Arctic such as the Bering and Chukchi Seas. These areas are immensely productive and rich in terms of both renewable and non-renewable resources.

The Beringean region is at times temperate and at other times arctic. Because of the seasonal ice cover, the total natural production of the Bering Sea is considerably enhanced. Two other major sources, rivers and lagoons, contribute to total production. The annual discharge into the Bering Sea from rivers of the USSR is about 100 km^3 of water. Alaskan rivers, particularly the Yukon and Kuskokwin, contribute about 300 km^3 per annum. Rivers bring in sediment, nutrients, and, in certain cases, pollutants, though so far only in small amounts. Lagoons are the other major source of biological production. It is obvious from this that rivers' and lagoons' contributing catchments are prime sites for the creation of biosphere reserves. A good part of the nutrition of the region depends on them. Ice is also implicated in the ecology of marine mammals and birds which are also dominant in Beringea. Far from impeding the distribution of marine mammals, sea ice aids some of them: there are 25 marine species found in Beringea. Birds and fishes are also extremely numerous in this region; the Bering Sea supports one of the world's greatest fisheries.

The major threat to the future survival of the highly complex and productive coastal marine ecosystem of Beringea is hydro-carbon (oil) spills under sea ice.

I have mentioned Beringea as an example of a large and highly productive Arctic marine area, where conflicts are shaping up between heritage preservation and economic exploitation. It is also an area where international cooperation is mandatory for achieving success, since this sea is a resource shared by several circumpolar countries and should be considered as one of the great commons.

Development of a regional biosphere reserve network in the Arctic is clearly relevant to environmental conservation and resources' management in northern countries. But their value and significance extends far beyond the north itself. To take monitoring in biosphere reserves as an example, polar regions constitute a special opportunity for monitoring atmospheric CO_2 and climate. Thus, it can be expected that the northern biosphere reserve network will become increasingly important as a place for permanent baseline studies within an emerging worldwide network for monitoring changes in the environment and in world climate, as initiated under UNEP/GEMS and WMO.

The Northern Science Network programme can also be seen as a logical counterpart to MAB studies in the humid and arid tropics. It is one end of the spectrum of MAB activities ranging from areas of high biological activity to those of low energy. Without studies in high latitudes MAB could not truly fulfill its mandate as a Programme on Man and the Biosphere.

I turn now to the Convention Concerning the Protection of the World Cultural and Natural Heritage (the "World Heritage Convention") which was adopted at the UNESCO General Conference on 16 November 1972 and came into force on 17 December 1975. Its origins can be traced to two separate, but related, factors. The first is that by 1972 the international community was becoming increasingly receptive to the concept of a "common heritage." In the context of the Convention, this concept maintains that there are certain outstanding natural and man-made features such as the Serengeti or the Pyramids, the Galapagos Islands or the Taj Mahal, which are more than the heritage of just one State. They constitute part of the heritage of all people, and mankind as a whole has certain rights with respect to their conservation. The second factor is that by 1972 the international community had shown itself willing to take positive action to help protect these sites. When the Nubian nomuments of the Upper Nile, including the 30 foot high statue of Ramses II at Abu Simbel, were threatened by flooding in 1960 as a result of the newly constructed Aswan High Dam, the response of the international community was prompt, and international campaigns were organised by UNESCO and others to save the famous monuments from destruction. On the natural side, the International Union for Conservation of Nature and Natural Resources (IUCN) was active in the 1950s and 1960s in securing protection for important natural habitats, aided by the financial support of a variety of governments, companies, and individuals. As the threats grew, however, it became increasingly evident that a permanent legal, administrative and financial framework for the identification and conservation of areas of outstanding cultural and natural importance would greatly assist the *ad hoc* efforts of UNESCO, IUCN and others.

The World Heritage Convention provides such a framework. Its objective is the protection of natural and cultural areas of "outstanding universal value," and it established a World Heritage Committee, a World Heritage List, a List of World Heritage in Danger,and a World Heritage Fund to help it achieve its goal. The World Heritage Committee is responsible for selecting cultural and natural sites of outstanding universal value and for including them in the World Heritage List or, if they are seriously threatened, in the List of World Heritage in Danger. The Committee is also responsible for using the money in the World Heritage Fund to help protect sites which have been or may be included in either of the World Heritage Lists.

Although it has only been fully operational for a few years, there are already signs that the Convention will prove to be an extremely useful legal conservation instrument. Almost fifty areas of outstanding natural, as opposed to cultural, value have been included in the World Heritage List, and the Convention has already helped protect several of them. The role played by the Convention in halting construction of a dam on the Franklin river Gordon-below, which would have flooded a large area of temperate rainforest in South West Tasmania, is probably the best-known example.

It was early recognized that the World Heritage Convention needs also to be implemented in the northern regions which are rich in terms of both natural and cultural heritage.

One outstanding example for international cooperation is the joint nomination and establishment of Kluane National Park located in Canada and Wrangell-St. Elias National Monument located in Alaska, USA, as a World Heritage property. This has created the world's largest Heritage site, covering 14 million acres, with superb features which alone justify its inclusion in the World Heritage List.

The dominant natural characteristic of the joint properties is the glacier ice and snowfields of the St. Elias Mountains. This is the largest non-polar icefield in the world and contains examples of some of the world's most spectacular glaciers. The recession and advances of the glaciers are the dominant natural force of the region. In particular, the area is noted for its concentration of presently surging glaciers. A recent example is the Steel Glacier, which surged over 8 kms during the period 1966-68.

The movement of glaciers in the World Heritage Site provides some of the best examples in the world of glaciation and the modification of landscape by glaciers. The geomorphic agents associated with glacial and peri-glacial environments — ice, frost, melt waters and wind — have been at work producing a wide range of interesting landforms, including significant examples of sand dune formations and loess steppes.

There is a rich variety of land ecosystems in the property. Within the montane forest, coastal forest, subalpine zone, and alpine tundra are complex and intricate mosaics of plant life at various successional stages. All forms of herbivorous animals common to Alaska and Northwestern Canada are represented in the fauna of the joint properties, some in numbers exceeded nowhere else. Over 14,000 Dall's sheep, the single largest group in the world, are found on lands encompassed by the nomination. Some 600 grizzly bears range through the area which is one of the largest protected populations in the world.

The immense size of the property contains the entire watershed of dozens of major rivers and pristine ecosystems that are unaltered by human activities and isolated by natural barriers from external influences. There are few places in the world where the ecological processes such as predation, migration, mortality, and natality are governed only by natural stresses and the evolutionary changes in the ecosystem.

As another example, there is the fascinating story of the first historic site to be placed on the World Heritage List symbolizing the common origin and close ties of the Circumpolar World.

One summer day nearly 1,000 years ago a long, high-prowed open boat from Greenland cast anchor at an island somewhere off the coast of North America. The single square sail was furled and the crew of 36 men went ashore. There was dew on the grass, and when they raised some to their lips, "It seemed to them that they had never tasted anything so sweet." Later they sailed on to the nearby mainland, where their vessel was left high and dry on shallows as the tide went out, so that "the sea seemed far away." Here, after getting off the flats and anchoring they built some shacks and spent the winter, fishing, hunting, and exploring. This is an excerpt from the *Groenlendinga Saga* describing Leif Ericsson's historic first contact with the continent which was later to be named North America.

It was nearly nine centuries later, in 1960, that a Norwegian explorer and writer, Helge Ingstad, came upon the site. He was making an intensive search for Norse landing places along the coast from New England northward; and at L'Anse-aux-Meadows beside Epaves Bay he discovered all that was left of that old colony, a group of grass-grown mounds which looked as if they might be house remains. The location fitted well with the Saga accounts; and so for the next eight years Helge and his wife, the archaeologist Anne Stine

Ingstad, led a group of archaeologists from Canada, the United States, Scandinavia and Iceland in excavations to explore the site. What their digs turned up was plentiful evidence of the first known European community in the Western Hemisphere.

L'Anse-aux-Meadows thus represents many firsts for the New World: the first European settlement; the first evidence of iron working; the first encounter between Europeans and native Americans. It is no wonder, therefore, that it was among the first 12 sites to be included on the World Heritage List in 1978.

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III. Arctic Research and the National Interest

A. Lincoln Washburn and Gunter Weller

(Abstract)[1]

The Arctic is important for many reasons — economic, political, defense-related, and scientific. It has now come into sharper focus because of the Arctic Research and Policy Act of 1984[2], the passage of which reflected an increasing awareness in Alaska, in Washington, and among scientists and others that U.S. Arctic research was lacking in continuity and overall direction. Thus the Act's purpose, among others, is:

> "... to establish national policy, priorities, and goals and to provide a Federal program plan for basic and applied research with respect to the Arctic, including natural resources and materials, physical, biological and health sciences, and social and behavioral science." (U.S. Congress 1984)

Two groups were established by the Act — (1) an independent Arctic Research Commission consisting of five Presidential appointees and the Director of the National Science Foundation as an ex-officio member, and (2) an Interagency Arctic Research Policy Committee, representative of ten named Federal agencies.

The Act specifies a number of national concerns regarding Arctic research, including energy resources, national defense, fisheries, global weather processes and forecasting, health and adaptation to Arctic conditions, communications, the fragmented nature of Federal research, neglected research areas, Arctic technologies and transportation, logistical support, cooperation with State and local governments in collecting basic data, long-range effects of development, international cooperation, and Arctic policy. All of these concerns involve many unresolved scientific and engineering problems requiring extensive, in-depth research if they are to be adequately met, whether in the physical, biological, or social sciences or in the various fields of engineering.

Examples of such problems include accurate geologic determination of oil, gas, and mineral resources; knowledge of the intricate ecosystems controlling the safe maintenance of various renewable resources important to world markets and to indigenous peoples; weather forecasting as affected by Arctic atmospheric processes; air-sea-ice interactions and other problems resulting from the unique nature of the Arctic Ocean — probably the least investigated of the world's oceans; the acoustical characteristics of Arctic seas as related to studies of marine mammals and detection of under-ice submarines; the problem of countering communication interruptions related to auroral activity; the possible warming of the Earth, especially the polar regions, perhaps associated with global rise of sea level due to accumulation of carbon dioxide and other "greenhouse" gases; and social studies relating to all the foregoing. There are countless other examples of needed research.

The very difficult task of priorizing the necessary research has just begun (Polar Research Board 1985). This and carrying out the research in the most economic and efficient way possible in the light of immediate needs and long-term national interests constitute a challenge requiring multidisciplinary interaction and cooperation. How well the challenge is met will affect not only those living in cold climates with the special problems posed by snow,

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[1] The full text has been published in *Science* 233:633-639. 8 August, 1986.
[2] See Appendix 1.

ice, and frozen ground, but also the nation as a whole. The importance of the Arctic with respect to resource development, national defense, and international cooperation with other Arctic-rim nations transcends any climatic boundaries.

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1984. *Arctic Research and Policy Act of 1984*. Ninety-eighth Congress, Sec. 102(b)(1). Washington D.C.

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IV. National Issues and Research Priorities in the Arctic — A U.S. Perspective

Gunter Weller

Introduction

The Arctic Research and Policy Act[1], signed by President Reagan in July, 1984, mandates the preparation of a comprehensive 5-year research plan for the Arctic. In October, 1984, the Polar Research Board was approached by the National Science Foundation, which chairs the new Interagency Committee with a request for help in preparing the five-year plan. The specific task given to the Board was to address a part of Section 109 of the Act, namely "an assessment of national needs and problems regarding the Arctic and the research necessary to address those needs or problems." In response the Board held three public meetings, received written comments from more than 100 individuals and organizations and met to determine the most urgent research needs in the physical, biological and social sciences, and in Arctic engineering. These needs will form the basis for the 5-year research plan, which is now being developed by the Interagency Committee.

The present paper is essentially the executive summary of the report that resulted from these efforts. The report was published by the National Academy Press in July, 1985, under the title: "National Issues and Research Priorities in the Arctic" (National Academy Press 1985).

Issues

Twelve broad issues of national concern in the Arctic [2] were identified, in which additional scientific and engineering research is necessary to fulfill the objectives of the Act. These issues, most of which are listed in the Act itself, are: basic knowledge of the Arctic (by using the Arctic as a natural laboratory), natural hazards, national defense, global climate and weather, energy and minerals, transportation, communications, renewable resources, pollution, environmental protection, health and adaptation, and Native culture.

Research Fields

To address the issues of national concern, research needs were organized under twelve broad headings identifying major fields of research. A brief rationale for each of these research areas follows, highlighting one or two major points to illustrate their role in Arctic research.

1. Upper Atmosphere and Near-Earth Space Physics

   A large fraction of the energy from the earth's space environment is deposited in the polar upper atmosphere giving rise to a variety of phenomena of great scientific interest, such as magnetic storms and the aurora. In the Arctic regions, these phenomena acquire practical significance because of their disturbance effects on man-made systems that are important to communications and defense.

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[1] See Appendix 1.

[2] Many of the topics addressed applied to regions with somewhat different natural boundaries than defined in the Act, e.g., the limit of discontinuous permafrost on land and pack ice on the ocean. We have adopted such modified boundaries as needed, while generally adhering to the definition of the Act.

2. Atmospheric Sciences

Polar atmospheric processes coupled to the ocean and snow and ice, help to determine climatic variations, and drive the oceans and their sea-ice cover by transfer of momentum, and in their extreme form manifest themselves as storm surges and other catastrophic events. Arctic atmospheric processes also carry pollutants, such as Arctic haze, and the Arctic is the region where the climatic "greenhouse" effects of radiatively active trace gases should be largest.

3. Physical and Chemical Oceanography

A unique feature of the Arctic Ocean and its adjacent seas is that about 60% of their total area is perennially covered by a layer of ice. Physical and chemical oceanography have as their main task the study of the large-scale circulation of the Arctic Ocean, its variability and the dynamics of ice and water masses, including the special role of the seas covering the continental shelves, major boundary currents and exchange with adjoining seas. Offshore petroleum extraction is hindered by insufficient knowledge of ice and oceanographic conditions.

4. Marine Life Sciences

Arctic marine ecosystems appear to be highly non-uniform because the Arctic environment is subject to extreme variability in both the space and time domains. The present view of the central Arctic Ocean as a biological desert may be seriously in error. Fishes and marine mammals are major elements of Arctic ecosystems that require research to study potentially adverse effects on them by offshore petroleum development.

5. Glaciology and Hydrology

Nowhere else is ice and snow in all its forms as widespread and diverse as in the Arctic or as important to human activities. Glaciology and hydrology are concerned with the role of these ice forms in climate, resource development and hazards such as glacier-dammed lakes, ice jams on rivers, surging glaciers, and snow avalanches.

6. Geology and Geophysics

The Arctic contains an actively spreading ocean basin with surrounding continental margins of various origins and is bounded on the south in Alaska by a volcanic island arc and an active subduction zone. Geology and geophysics deal with the assessment of the potentially enormous mineral and petroleum resources in this highly active geological setting, and with the study of plate tectonics and the associated high volcanic and seismic risks.

7. Permafrost Research

Permafrost is widespread in the Arctic and presents a major problem in the construction of roads, pipelines, and other structures. Three quarters of Alaska and much of the continental shelf of the Arctic Ocean are in the permafrost zone, which reaches up to 600 meters in thickness. Permafrost research has to find methods to detect ground ice, and has still much to learn about the basic properties and processes in permafrost.

8. Arctic Engineering

Arctic engineering has a principal role to play in resource extraction, protection against natural hazards such as sea ice, permafrost, earthquakes, and tsunamis, and in transportation and defense. Particularly ice and permafrost provide new challenges to Arctic engineering, since there is no basis of experience for this from other parts of the world.

9. Terrestrial and Freshwater Biology

Arctic environments represent an extreme with respect to temperature and seasonality, in a range of environments to which life has become adapted. Terrestrial and freshwater biological sciences in the Arctic need to study the poorly understood basic functioning of the terrestrial ecosystems and the possible effects of industrial development and pollution on these systems.

10. Medicine and Human Biology

Medical problems in the Arctic are often linked to sociocultural and behavioral patterns, or to injury produced by low temperatures. Medical and human biological research have to deal with community health, and disease and nutritional problems which are peculiar to the Arctic regions.

11. Social and Cultural Research

In many ways, the social and cultural problems of the Arctic are similar to those in the developing countries. Social and cultural research have great opportunities to test models for the organization of health, education, and cultural services, in the new political and economic units of the Arctic. Studies of traditions, language, and history are also important.

12. Economics

Interdisciplinary research in the Arctic also needs to include economics. Conventional application of economic theories with regard to energy and mineral development, renewable resources and transportation systems, have limited application in the Arctic because of the remote character of most of the region.

Major Research Priorities

There are thus unique and important research needs and opportunities in the Arctic. In order to determine the major research priorities, a matrix was devised in which the issues are arranged against the various scientific and engineering research fields under which the research is to be carried out. The matrix (see Figure 1) indicates which areas need additional research of high priority. For each of the twelve broad research fields listed, between four and six major research priorities were identified. Many of these are interdisciplinary or multidisciplinary in nature, and may address more than one issue. The top priority in each research area is listed below. No attempt was made to establish priorities *between* different fields of research.

Upper Atmosphere and Near-Earth Space Physics

Coordinated research effort is needed to improve predictions of auroral, ionospheric, and magnetic perturbations.

Atmospheric Sciences

Long-term monitoring of atmospheric constituents and related physical parameters is needed in order to understand such phenomena as Arctic haze and the global "greenhouse" effect.

Physical and Chemical Oceanography

A major increment is needed in instrumentation and long-term oceanographic and sea ice measurements, using satellites, moorings, buoys, floats, and chemical tracers.

Marine-Life Sciences

Integrated long-term studies of the structure and function of Arctic marine ecosystems are needed on the major Arctic continental shelves.

Glaciology and Hydrology

Geographically broadened programmes of shallow, intermediate and deep ice coring in Greenland and on ice at high altitude are needed for paleoclimatic reconstructions.

Geology and Solid Earth Geophysics

Geologic mapping in Alaska is needed at both reconnaissance and detailed levels for resource assessment and understanding the basic tectonic framework of that area.

Permafrost Research

The construction of roads, pipelines, and other structures in permafrost terrain requires new and efficient detection methods to map ground ice and permafrost.

Arctic Engineering

Collections of statistical data on size, distribution and movement of sea ice features, particularly multi-year ridges and ice islands, is needed for the design and construction of offshore platforms.

Terrestrial and Freshwater Biology

Monitoring of natural responses and man-induced effects is needed at a new long-term ecological research site in the Arctic.

Medicine and Human Biology

A community health focus is needed, encompassing individual and aggregate survival and well-being in the context of family, community and cultural integrity, continuity and adaptation.

Social and Cultural Research

Study of new political and economic units and their functions is needed, including corporate structures, land ownership, and management and leadership training.

Economics

Study of alternatives for mineral development, renewable resources, transportation systems and subsistence and mixed economies is needed.

General Recommendations

In order to carry out the above research effectively, a number of conditions must be met, as specified by the following general recommendations (not in order of priority):

1. Concerns of Arctic Residents:

   Residents of the Arctic should be involved in the planning and design of research programmes that deal with problems of the environment in which they live, and with man's activities in this environment.

2. Education:

   Incentives should be developed and stable educational opportunities provided for students to train in and enter professional careers devoted to Arctic research. There are presently few such incentives, and hence a shortage of scientific manpower exists.

3. Government/Industry/Academic Interactions:

   The fragmentary approach to research in the Arctic, as practiced in the past, should be replaced with a better, cooperative research strategy involving all sectors of society conducting research in the Arctic. This strategy must also address issues such as proprietary data and effective transfer of scientific results for regulatory purposes.

4. Satellite Observational Systems:

   To obtain synoptic coverage of the Arctic by satellite, appropriate read-out stations on the ground should be planned and developed, to receive data from both domestic and the increasing number of foreign satellites.

5. International and Global Aspects:

   Many of the issues and concerns in the Arctic, such as climate change and pollution, transcend national boundaries and should be tackled within a wider framework in which international cooperation is essential.

6. Logistics and Support Facilities:

   Logistics and support facilities in the Arctic should be improved and their use coordinated in a way similar, for example, to the Canadian Polar Continental Shelf Project. To carry out the research recommendations of this report there is a need for the acquisition (charter or construction) of a dedicated polar research ship and a permanent logistics base in close proximity to the Arctic coast.

7. Multidisciplinary and Interdisciplinary Projects:

   Some of the proposed research projects can only be carried out effectively on a multidisciplinary or interdisciplinary basis, in which the various disciplines interact actively. Such cooperation, for example in the study of Arctic marine ecosystems, should be encouraged.

8. Balance of Large and Small Projects:

   Because of the very high cost of logistics in the Arctic there is a need for "Big Science" projects, in which logistics resources are pooled. There should be a proper balance between such large multi-year science and engineering projects, however, and small, individual projects.

9. Interaction between Science and Engineering:
To develop the special technologies which can cope with the Arctic environment, there is a need for better interaction between science and engineering, particularly in the development and exchange of fundamental research results and the engineering applications of concepts, products, and materials.

10. Long-term Monitoring and Baseline Data:
Long-term research sites should be established and operated in the as yet relatively undisturbed Arctic, at which natural and man-made changes can be monitored. Also collection of baseline data through surveys, mapping, and inventories is very fragmentary and is needed for the entire Arctic. This includes continuous, reliable demographic and epidemiological statistics, for example.

11. Data Management and Analysis:
Efficient compilation, cataloging, and preservation of data in all disciplines is needed for the Arctic on a regional basis. Data synthesis and publication in the accessible, refereed literature must be encouraged in the future. This is not a problem unique to the Arctic.

12. Geographical Balance:
Although the bulk of U.S. research should continue to focus on Alaska and its surrounding seas because of the prime interest of the U.S. in that area there should also be a geographically-balanced research programme, covering other parts of the Arctic.

Reference

Polar Research Board
1985. *National Issues and Research Priorities in the Arctic*. National Academy Press. Washington, DC. 124 pp.

RESEARCH TO ADDRESS NATIONAL ISSUES	NATIONAL ISSUES IN THE ARCTIC											
	ARCTIC AS A NATURAL LABORATORY	NATURAL HAZARDS	NATIONAL DEFENSE	CLIMATE AND WEATHER	ENERGY AND MINERALS	TRANSPORTATION	COMMUNICATIONS	RENEWABLE RESOURCES	POLLUTION	ENVIRONMENTAL PROTECTION	HEALTH AND ADAPTATION	NATIVE CULTURE
UPPER ATMOSPHERE AND NEAR EARTH SPACE PHYSICS	✓		✓				✓					
ATMOSPHERIC SCIENCES	✓	✓		✓					✓			
PHYSICAL AND CHEMICAL OCEANOGRAPHY	✓	✓	✓	✓	✓	✓		✓		✓		
MARINE LIFE SCIENCES	✓			✓	✓			✓	✓	✓		✓
GLACIOLOGY AND HYDROLOGY	✓	✓		✓	✓			✓	✓			
GEOLOGY AND GEOPHYSICS	✓	✓		✓	✓							
PERMAFROST RESEARCH	✓	✓	✓	✓	✓	✓		✓		✓		
ARCTIC ENGINEERING	✓	✓	✓		✓	✓	✓	✓		✓	✓	
TERRESTRIAL AND FRESH-WATER BIOLOGY	✓			✓				✓	✓	✓		✓
MEDICINE AND HUMAN BIOLOGY	✓								✓		✓	✓
SOCIAL AND CULTURAL RESEARCH	✓				✓		✓	✓			✓	✓
ECONOMICS	✓				✓	✓		✓		✓		✓

Figure 1. Matrix of major research priorities. The tick marks indicate which research fields have high priority in relation to the national issues. They are arranged with the physical sciences on the top, and the biological and social sciences at the bottom. This does not imply any order of priority.

Figure 1.

V. A Forecast of Alaska's Research Needs

Lyle D. Perrigo

> To survive — to continue and to enhance the good life its people now enjoy — what does Alaska need to know about itself, its total environment, its people? No other state has ever had the opportunity nor the responsibility to investigate critically its resources, determine where it wants to be 50 or a 100 or more years from now, and programme a sustained, coordinated, and long-range effort to accomplish these goals.

In an attempt to address this challenge, the University of Alaska Foundation initiated a programme to evaluate research needs for Alaska. The Foundation established a Scientific Advisory Commission to evaluate information and finalize recommendations. Their work is summarized in the report, *A Challenge to Alaska* (University of Alaska Foundation 1985).

The Alaska Research Development project was planned and initiated by the University of Alaska Foundation for the purpose of obtaining the research information that will be needed to give the State the best attainable future over the next 50 to 100 years or more. This report is a first step toward that goal. Its objective is to identify the kinds of research information that will be most needed. The recommended studies are grouped into four areas:

1. Research needed for the wise development and use of the State's natural resources. These research areas include energy, defense, mineral resources, fisheries, forestry, and food and agriculture; and also the collection, storage, and dissemination of information; the state's transportation systems; and materials research and engineering.

2. Research needed to provide for the care and preservation of the State's natural resources and the culture and heritage of its diverse peoples. These research areas include man-made changes in weather and climate, including the possibility of a warming trend of the whole earth; environmental protection; and archaeological, anthropological, and linguistic studies of the native populations.

3. Research needed to protect the health and well-being of Alaskans. Three topics are considered: health and disease, social pathology, and building construction and maintenance.

4. Research on topics for which Alaska is a "natural laboratory" compared with other parts of the nation, and research on topics that support and contribute to improvements in many of the topics listed above. These research areas are: the upper atmosphere; weather and climate; geology; natural hazards; snow, ice, and permafrost; northern oceans; and human resources.

Research on these topics will continue for many years. Detailed decisions concerning priorities can therefore better be made gradually, by the research groups that will be involved. At this time, however, ten major conclusions and recommendations can be stated. They are given in approximately the order of discussion in the report, not in priority order.

1. Some time within the next century, or less, the U.S. will switch from petroleum and natural gas to some other major source of energy, most probably coal or nuclear fission. As oil and gas become too expensive to burn as fuel, Alaska will have several opportunities to contribute to the nation's energy needs by developing its coal, geothermal, or hydroelectric resources. As the smaller scale use of these resources for Alaska's own needs continues, opportunities should be grasped to gain information and experience that will be valuable in planning later and larger-scale developments.

2. The coordinated study of oceanography and the basic biology of marine food chains and the harvested species that depend upon those food chains, and the concurrent collection of information on which to base permanently effective and profitable management practices constitute an important area of needed research.

3. The relatively new field of genetic engineering gives promise of making major contributions to the improvement of agriculture.

4. There are strong indications that the earth will become a few degrees warmer in the next century or less, due to the increase of carbon dioxide, methane, and other "greenhouse" gases in the atmosphere. If so, Alaska and its surrounding seas will warm up considerably more than will more temperate latitudes; the Arctic Ocean may become largely ice-free in the summer months; and Alaska will be one of the places where the warming trend will first become clearly evident. Unlike much of the world, the warming trend may have some advantages for Alaska. The changes that would be necessary to adapt to that condition, for example those involved in agricultural practice, are generally desireable in any event.

5. Damage to the environment is slower to heal in cold climates than in warm ones. Toxic pollutants to land or water last longer than in a warmer region; and in Alaska and its surrounding seas some dangers, such as an oil spill at sea, are most likely to occur at the same sites that are biologically most productive. Research directed toward environmental protection is therefore even more essential in Alaska than in many other regions.

6. Native speakers of Alaska's Aleut-Eskimo and Indian languages are rapidly disappearing, and archaeological sites are being destroyed by erosion, industrial or other development, and clandestine excavation. If better knowledge of the culture, history, and protohistory of these peoples is to be obtained, there is an urgent need to identify and protect archaeological sites and to accelerate the collection, recording, and analysis of cultural traditions and native languages.

7. A major need in the field of health is for more accurate, detailed, and comprehensive health data of two kinds: (a) systematic analysis and dissemination of health information relevant to Alaska's special needs; and (b) epidemiological data that can be used to monitor the health of Alaskans and to improve their health services.

8. Residents of Alaska are subject to relatively high-levels of stress. The State also has high rates of suicide, violence, and accidents. Research on the climatic, environmental, and social factors leading to stress deserves high priority in order to determine the causal relationships that may be involved, and to determine how suicide, violence, and accident rates may be reduced.

9. Most of the research recommended is of a practical nature and is applied to recognized problems of the development of resources or the protection of the environment and the health and well-being of citizens. In addition, Alaska has a special opportunity to study those scientific and technical issues for which its high geographic and geomagnetic latitudes give it particular advantages. The results will contribute to the world's knowledge, and will aid in understanding and coping with many practical problems.

10. The most insistent single recommendation expressed by the many people consulted in preparing this report was for better basic data, both over time and from throughout the State. Public health workers need better epidemiological information. Those working on the understanding and mitigation of natural hazards need continuing statewide information on seismicity, as do scientists working on basic problems in geology. The prospective warming trend and the need for environmental protection make it highly desireable to develop a more thorough, more comprehensive, and long-continuing system of monitoring environmental variables throughout the State. This would facilitate the understanding of trends and the ability to take remedial action early enough to be effective at reasonable cost. Students of snow, ice, or permafrost, those primarily concerned with weather and climate, fisheries experts, and others make a strong case for the need for better baseline data so that trends and changes can be monitored and the effects of human intervention — whether intended or accidental — can be distinguished from natural fluctuations. Again and again, the plea has been for better baseline information, more systematically collected and analyzed, and made more easily available to those who need it.

Because of the overlapping needs of the several fields of work and because of interrelationships among the types of data needed, it will obviously be desireable for joint planning by specialists from several areas in order to decide upon the kinds of data most needed and the methods of collection, reduction, and reporting that will be most useful.

Positive methods must then be developed to make certain that the data and information are available to those who can use them in the many kinds of studies, planning activities, and decisions that will determine how successfully Alaska actually achieves the future it considers most desireable.

Finally, adoption by the Federal government of the Arctic Research and Policy Act of 1984, appointment of the Arctic Research Commission and the Interagency Arctic Research Policy Committee called for in that Act, and the beginning formulation of the national Arctic research programme plan to implement the Arctic research policy will all be of benefit to the State. However, the emphasis of the Act is on national needs, not the needs of the State. There is much overlap, yet if the State's priorities are to be given full weight in planning future research, a State organization is needed to formulate policy, sponsor research, establish priorities, and make certain that the kinds of studies called for in this report are emphasized. Appointment of a science advisor to the Governor is a welcome initiative. What remains to be done is to decide upon the nature, organization, financial support, and authority of an organization to support and carry out the expectations of an "Alaska Research and Policy Act" dedicated to the best attainable future for the State.

The Foundation's challenge to the State — to look ahead 50 to 100 years — poses a difficult problem: How can one look that far into the future and plan for the kind of

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knowledge that will be needed under the different conditions of those future years? One of the most essential foundations for looking well into the future is to understand as thoroughly as we can how current conditions are changing and what current trends predict for future years. Accurate, comprehensive, and soundly analyzed baseline data are essential for that purpose. So is a clearly reasoned vision of what is wanted for the future. Employing the most highly qualified individuals the State can attract for research and for management and planning will help to supply the State with persons of vision.

Reference

University of Alaska Foundation
1985. *A Challenge to Alaska*. University of Alaska Foundation. Fairbanks, Alaska. 52 pp.

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VI. Formulating U.S. Arctic Research Policy: Recommendations from Alaska's North Slope Borough

George N. Ahmaogak, Sr.

The North Slope Borough occupies much of the U.S. Arctic and extends from the crest of the Brooks Range to the Chukchi and Beaufort Seas. The Borough is the largest municipality in the U.S. (88,000 square miles) and is very sparsely populated. Although the largest producing oil field in North America is located within the Borough, most of our full-time residents still rely heavily upon the subsistence way of life. It is common knowledge that during the past 10-15 years major changes have been occurring within the North American Arctic and that the major force behind these changes has been the exploitation of non-renewable resources. This tremendous increase in industrial activity within the U.S. Arctic is having significant effects upon the land and waters, the animal and plant life, and the lives of the residents of the Arctic. This reality of life in the Arctic *must* be clearly recognized by those people who are involved in the formulation of U.S. Arctic research policy. Many of the comments and recommendations that follow relate to this increase in industrial activity and to assessing associated impacts.

A detailed listing of some of the more pressing Arctic research needs is given in a report by the North Slope Borough's Science Advisory Committee, entitled *Research Needs in Environmental Science and Engineering for the U.S. Arctic (1985-1989)*. This report, dated May 1985, can serve as a useful background document. However it is possible to continue from there to make some specific recommendations. What follows are twelve obvious recommendations regarding the formulation of U.S. Arctic research policy.

Recommendation #1: Arctic residents must be involved in both the formulation and implementation of Arctic research policy.

Policy makers must remember that there are U.S. citizens living in the Arctic. Unfortunately all too many people view the U.S. Arctic as just a store-house of mineral wealth. The North Slope Borough includes the largest producing oil fields in North America and its extracted resource benefits the Borough, the State, and the nation. However, the environmental impacts are felt primarily within the confines of the North Slope Borough. It is important to keep this in mind when formulating and implementing Arctic policy. As Arctic residents, we want to become more involved in research and policy decisions that affect us. We intend to move forcefully in whatever forums are available to us so that decisionmakers at all levels will be reminded that we have concerns and we want them addressed.

Recommendation #2: Provision must be made for the documentation of social, cultural, and economic change among Arctic residents so that negative influences can be identified and dealt with appropriately.

Unfortunately, as the level of industrial activity continues to increase, impacts on the traditional way of life and the sociocultural fabric of the Inupiat also seem to be increasing. In order to maintain our cultural identity we must deal with negative influences as effectively as possible. In this regard, one of the most obvious major impacts on the Inupiat culture has been the imposition of severe restrictions upon our subsistence hunt of the bowhead whale. It is negative influences such as this that must be identified and dealt with if our culture is to survive.

Recommendation #3: Provision must be made for determining the nature of adverse health-related changes occurring among Arctic residents.

As varying degrees of "prosperity" come to Arctic communities there is the potential for adverse changes in the incidence of various diseases and activities that affect health. We are particularly concerned with problems such as alcohol and drug abuse and whether the incidence of various disease conditions, such as cancer, is changing.

It is our view that Arctic research policy should be structured so that the maintenance of the health and cultural identity of Arctic residents is given high priority. This seems to be a fair request in view of the major changes that the "outside world" is more or less forcing upon us as the result of the rapidly increasing industrialization of the U.S. Arctic.

Recommendation #4: Make provision for obtaining the basic data needed for the sound management of subsistence-use Arctic animals.

This lack of critical data is particularly obvious for such important subsistence-use animals as bowhead whales, walrus, and certain anadromous fishes, particularly the Arctic cisco. This lack of critical data for certain species seems to assure continued controversy regarding harvest levels, industrial impacts, and management schemes. Unfortunately the picture is further clouded by speculation that the management of certain marine mammals may be transferred from the federal to the State government.

Arctic residents want to be involved in the gathering of such data and in the formulation of management plans for our subsistence-use animals. In this regard we are especially proud of the precedent set by the Alaska Eskimo Whaling Commission as an effective force in the management of the bowhead whale.

Recommendation #5: Make provision for obtaining the data necessary to protect the bowhead whale from undue impact from offshore industrial activity.

The bowhead whale is the most important subsistence-use animal to the people of the coastal villages of the North Slope Borough. We are very concerned that offshore industrial activity, particularly noise and potential oil-spills, poses a very grave threat to the bowhead and to our subsistence hunt. There is already the feeling by Barrow and Nuiqsut hunters that fall migrating whales are being displaced seaward by the noise from seismic exploration vessels. There is increasing seismic vessel activity in the Barter Island area so that we now fear that the fall hunt at Kaktovik will be impacted and the whales feeding in the area between Barter Island and the Canadian border will be interfered with. Proposed offshore drilling, using drillships, on the fall migratory route of the bowhead and during the actual migration poses a clear threat due to noise disturbance and potential oil-spill. The North Slope Borough is firmly committed to the protection of the bowhead whale and its major habitat from undue industrial disturbance. Our commitment to protect the bowhead should be recognized by all parties concerned so that situations inviting controversy can be minimized.

In view of the seriousness of this situation I urge that Arctic research policy be formulated so that emphasis is given to help resolve differences between subsistence hunters and those seeking to conduct offshore industrial activities that may impact the bowhead whale and/or our subsistence hunting.

Recommendation #6: Provision should be made for the encouragement of research that will enhance the safety of offshore industrial activity and help to reduce adverse impacts.

We are particularly concerned that industry only be allowed to move into the offshore area when technology is available to provide for safe operation and minimal risk to the environment. As noted earlier, our concerns focus primarily upon impacts to the bowhead whale and subsistence-use anadromous fishes such as the Arctic cisco.

Although there are many areas where additional data are needed, we feel that the following are especially relevant:

a) determining the adequacy of offshore drilling structures, particularly regarding resistance to sea ice,
b) determining the risk associated with sub-sea pipelines, particularly in permafrost areas,
c) determining the adequacy of oil-spill trajectory models,
d) assessing the adequacy of methods for dealing with spilled oil,
e) determining the risks associated with the use of tankers in ice-dominated waters, and
f) trying to assess the environmental risks posed to both the U.S. and Canada by the other's Beaufort Sea operations.

Recommendation #7: A mechanism should be provided whereby long-term environmental monitoring is required for major industrial actions.

If impacts to the environment and to subsistence activities are to be kept within acceptable bounds, there must be a means whereby major industrial actions are monitored over the long term. Long term means 5 to 15 years and not just 1 or 2 years. Unfortunately it is often felt that if a major impact is not detected in 1 or 2 years, then there is no longer a need to worry. We feel that long-term monitoring is necessary and that any such effort must be well thought out in advance and properly funded. If significant impacts are detected there must be a regulatory mechanism in place to require that appropriate mitigative measures be taken.

Although there are many other examples, one of our major concerns in this regard is the long-term effect of gravel causeways upon the nearshore movement of fish. Since subsistence fishing is very important to us we will continue to work to make long-term environmental monitoring programmes a requirement for such structures.

Recommendation #8: A mechanism should be established that would identify and facilitate the use of specific sites that can provide logistical support for the conduct of Arctic research.

The former Naval Arctic Research Laboratory (NARL) at Barrow played a central part in the support of Arctic research over the years. Unfortunately, NARL was closed for a period. It has reopened as UIC/NARL and is being operated by the Ukpeaqvik Inupiat Corporation. Let us hope that it receives the support needed so that it can again become a site for the conduct of Arctic science.

In addition to a facility such as UIC/NARL there should be other smaller support sites throughout the U.S. Arctic. This does not mean that there should be many specific sites constructed just for research support, although at least a few small sites should be constructed in carefully selected locations. Rather, a way should be found to allow for the use of selected existing private, industrial, and governmental facilities for the support of science. Such sites could be in the various villages as well as Kuparuk and Prudhoe Bay. Serious thought should be given as to how such existing facilities could be utilized by scientists at least on an occasional basis. This could lead to the regular movement of scientists into many areas without excessive logistics expenses.

Recommendation #9: Provision should be made to strongly encourage scientists to publish their Arctic research findings in scientific journals in a timely manner.

Unfortunately much of the research done in the U.S. Arctic only finds its way into final reports and thereby stays sequestered in the "grey literature." Such research is essentially hidden from most of the world because of the very limited distribution of these documents. Another obvious problem with such grey literature is that it is seldom subjected to peer review.

It is doubtful that there is any other region in the U.S. where such a significant proportion of the research done only appears in the grey literature. This is a well recognized problem by many Arctic scientists and we should move strongly to correct this obviously wasteful situation.

Recommendation #10: Arctic research policy should be designed to increase the level of Arctic research so that the level of research is at least related to the level of industrial activity.

Unfortunately over the last few years the level of Arctic research seems to have been decreasing while the level of Arctic industrial activity is increasing. It is our view that the level of Arctic research should be greatly expanded and at the very least be related to the level of Arctic industrial activity.

Although there are many, many areas of Arctic science that need additional effort, one area that is especially important to us is the need for long-term studies to detect environmental, sociocultural, and economic changes associated with industrial activity.

While there are billions and billions of dollars extracted from the ground there should be at least a reasonable investment in the monitoring of associated impacts. We should stress the need for the long-term monitoring of industrial activity in the Arctic. We need well designed, scientifically sound programmes so that impacts can be detected and steps then be taken to modify the industrial activity so that significant impacts are reduced or eliminated. In this regard we see an unhealthy emphasis on short-term studies, with long-term studies receiving little more than lip service. We are especially concerned about the long-term industrial impacts upon our subsistence-use animals, particularly the bowhead whale. Similarly, we are very concerned with the related long-term sociocultural and economic impacts upon our people, the residents of the U.S. Arctic.

Recommendation #11: Arctic research policy should be structured so as to encourage the development of young Arctic scientists and a good mix in the proportions of the research conducted by private firms, government agencies, and the academic community.

In the past few years there has been an overall decline in the level of research conducted in the U.S. Arctic as well as an apparent marked decrease in the proportion of the research being conducted by government agencies and academic institutions. In our view both of these trends are alarming. This decline in the level of research in the U.S. Arctic was noted previously. The present shifting of the conduct of research away from the academic community is not good and seems destined to greatly undermine the training of new scientists with an interest in the Arctic. Work must be done to help increase the participation of government agencies and especially academic institutions in the field of Arctic research.

Recommendation #12: Arctic research policy should be structured so as to strike a good balance between basic research and research of a more applied nature.

Much of what has been recommended so far has been concerned with the need for research of an applied nature. Such research seeks answers to more or less immediate needs. This emphasis upon questions of a more applied nature is a reflection of the tremendous need for "answers" that presently exists. This long list of questions that need to be answered is also a reflection of at least the following two things.

(i) Major changes are taking place in the U.S. Arctic as a result of rapidly increasing industrial activity.
(ii) The level of U.S. Arctic research never was very high and in recent years has been declining even as the need for answers is increasing.

In conclusion, even if the level of Arctic research increases markedly it will still be years before we have caught up with the many, many unanswered questions before us. It must be remembered that the Arctic is our home and as it is exploited for its non-renewable resources we pray that it is not irreparably harmed.

VII. The Necessity of International Exchanges Among the Northern Regions

Sumio Hasebe

Hokkaido, the northernmost island in Japan, has been involved in international exchanges among countries in the northern hemisphere for the last 14 years. Before describing how and why international exchange developed in Hokkaido, it is necessary to discuss how recent nationwide internationalization has taken place in Japan. At present, different regions in Japan have become more internationalized, and international exchanges in many fields (economy, culture, education, and others) have become more active. In the last 20 years, Japan has made rapid economic progress, which has created a need for Japan to participate in the international market. The results are, first, it became indispensable to open up local societies to the world. Consequently, Japanese people have recognized the need for nation-wide internationalization, rather than centralizing international relations in cities such as Tokyo. Second, there has been a tendency to utilize the phenomenon of regional internationalization for the economic development of local areas. That is, the internationalization of a region is seen as a positive force to activate the economy in a community. Third, international exchanges provide an opportunity for people in communities to broaden their perspective of the world.

Another factor favoring regional internationalization is the overpopulation of major megopolitan areas in recent years. Less-populated areas are now able to provide both an abundant and less expensive labor force as well as a rich natural environment. Taking advantage of beneficial conditions for new investment, local communities have encouraged foreign enterprises to establish businesses in their areas to activate the local economy and improve communication networks, airports, rapid transit systems, and the education of needed personnel.

What has been described so far are the reasons for and typical patterns of internationalization at the prefectural, city, and town levels. In addition to these general factors, the international exchanges between Hokkaido and the countries in the northern hemisphere have a number of unique elements.

Due to the severe climatic conditions, which are so different from other parts of Japan (such as Honshu), the development of Hokkaido under governmental policy has only occurred in the last 100 years. Being nearly untouched until then, Hokkaido quickly became developed by people who moved there from other parts of Japan. Presently, Hokkaido's population has grown to 5.7 million. However, Hokkaido fell behind the rest of Japan during the period of rapid economic growth and industrialization which started in the 1960s, and has always been considered an industrially underdeveloped area. In 1971, the Hokkaido Government announced a long-term comprehensive developmental plan, and the "Northern Regions Exchange Plan" was proposed in it. This plan aims to free Hokkaido from being an underdeveloped and isolated area in Japan and to facilitate its unique development by promoting economic and cultural exchange with countries of similar climatic conditions. Various policies were introduced to undertake this plan.

In response to this plan, a private organization was set up in 1972 which started projects such as cultural exchanges, research studies and an information center. In 1978, this organization was reestablished as the present Northern Regions Center (NRC). The NRC was authorized by the Prime Minister and has now become one of the most active organizations in international exchange, having 4,300 members and including both corporations and individual members. The NRC has been involved in various activities organized under the Northern Regions Exchange Policy of the Hokkaido Government. The principle of its activity is "to establish a more pleasant and rich community by learning from each other and cooperating among countries in the Northern Regions and to ultimately improve life and the environment in Hokkaido as well as in the other countries who share these severe climatic conditions." The

Northern Regions is not interpreted as being limited geographically, but applies to areas in the northern hemisphere with cold climates and snow fall. The areas with which Hokkaido has exchanged so far are the northern states of the U.S., including Alaska, all the provinces of Canada, Northern Europe, Siberia in the U.S.S.R., the northeastern part of China, and others. People from Hokkaido who have visited or studied these areas have observed noticeable differences in lifestyles and ways of thinking. Noteworthy differences were found in the practical knowledge and ideas applied to life in the north, rational concepts about the living environment, preservation of traditional arts and crafts, and efforts and enthusiasm toward the improvement of social welfare. These findings have been passed on to numerous other people.

The knowledge gained by the Northern Regions Exchange has been put into practice in the past 14 years in broad areas such as peoples' lives, culture, sports, industry, and economy. Now these ideas are well accepted by many people in various fields. Furthermore, concepts have spread to local communities and to different groups of people in Hokkaido. As a result, a number of exchange activities have taken place in local communities. The total number of participants in these events is astronomical.

What elements of the Northern Regions Exchange motivated this many people in Hokkaido? The programme has had a strong impact on peoples' lives and culture, which no other exchange projects have done. In general, the international exchange aims to promote international understanding, friendly relations, and international cooperation among the participating countries. However, these goals are not enough to motivate the general public to understand and to actually take part in the activities.

The NRC has been involved in a number of activities. There are three major areas that have been emphasized: 1) gathering and providing information concerning northern regions, 2) research concerning northern regions, and 3) promotion of exchange with other countries in the northern regions. Specifically, the NRC has organized international conferences on topics concerning northern regions, missions to and from overseas, social gatherings and parties relating to international exchanges, exhibitions on northern regions, lectures, seminars, and other events. The NRC publishes a magazine, an English-language Newsletter, books, and reports on the results of NRC sponsored-research. It also has a library where books and papers are stored and provided as needed, and conducts language courses which are open to the public. To make the activities of the NRC more workable, the Northern Regions Exchange Foundation was established. This foundation provides financial assistance to exchange projects set up by individuals and organizations in Hokkaido.

For sources of revenue, the NRC is basically supported by membership fees from 1,800 corporate and 2,400 individual members, which accounts for 40% of the total annual budget of 160,000,000 yen. An additional 15% is provided by subsidies from the Hokkaido Government, and the remaining 45% comes from revenues from NRC projects. The NRC also has facilities such as a conference room, reception hall, exhibition hall, and library in the annex of the Hokkaido Government building. These facilities are open to the public at no charge and are for the use of international exchange events.

Half of the support for the Northern Regions Exchange Foundation is provided by the Hokkaido Government and half comes from public donations. At present, the Foundation has revenues reaching 420,000,000 yen, and the interest is provided as subsidies for private exchange projects.

It is now possible to see observable changes that have taken place in many areas as a result of the Northern Regions Exchange projects. This indicates that the active exchanges among northern region countries, such as study missions and research projects, have influenced the Hokkaido people and motivated them to start creating new lifeways and culture unique to the north.

To clarify, what follows are six examples of the major changes that have occurred. First, a number of private friendship exchange organizations have been formed, such as the Northern Regions Exchange Association of cities, towns, and villages, and the Hokkaido Economic-Exchange Association. In addition, many cities, schools, and organizations have set up a sister relationship with their counterparts overseas.

Second, houses suitable to our climatic conditions have been developed and promoted as a result of the long-term effort of the NRC in collecting data on houses in northern Europe and Canada and providing advice to house builders in Hokkaido.

Third, winter clothing developed and manufactured in Hokkaido will soon go on the market as a result of a campaign worked out by the NRC. Previously, clothing worn in Hokkaido during the winter was manufactured in Honshu and consequently was not suited to the Hokkaido climate. The NRC finally made manufacturers aware of the need to create clothing unique to this northern lifestyle and climate.

Fourth, since 1980 the northern region countries of Sweden and Finland have approached Hokkaido for economic exchanges. Due to their efforts, imports and the introduction of technology concerned with houses, log houses, house-related items, and furniture have been realized. Enterprises in the U.S. and West Germany have shown their interest in establishing factories as part of the industrial base in Hokkaido.

Fifth, cross-country skiing and curling, winter sports which the NRC took the initiative in introducing to Hokkaido, are now enjoyed by many people. There have been large-scale competitions in Hokkaido involving great numbers of people, such as a competition involving 100,000 people and one authorized as the World Ropet.

Sixth, numerous universities and institutions in northern regions recently contacted the NRC asking for information and material concerning the northern regions. Within Hokkaido, active exchanges have taken place in the area of cold-climate studies between the NRC and these bodies.

What has been presented so far is an outline of the international exchange activities begun 14 years ago, and the impact that these have had on the local communities and people. However, it is too early to fully appreciate the results of this experiment in international exchange involving our communities. It remains questionable whether such international exchanges could be adapted to other cold regions. Nevertheless, it is of great importance for related organizations in the northern regions to establish corporate systems for the purpose of improving living conditions in cold regions. In conclusion, mutual cultural impacts provide the best way to approach our goals, as they create a human exchange among countries, nations, and regions, and eventually stimulate people to engage in academic and technical studies or even economic exchanges such as trade. Houses, clothing, food, the environment, and the general living conditions directly related to peoples' lives are always challenged by nature. They are being continually tested for improvement by every country in the northern hemisphere, particularly in the numerous countries with advanced science, technology, and industry. Some solutions to questions of improving the lives of northern residents may come from scientific and technological approaches. However, it is evident that more effective solutions are provided by the cultures which northern nations and regions have fostered over the years. The best way to improve living conditions in northern regions may be through international exchanges which bring about mutual cultural stimulation in the communities involved. It is not unrealistic to think that some day many organizations, groups, and individuals will take the initiative in exchange activities at both the private and governmental level. Although there may be a time when free exchanges are restricted due to friction and confrontations among northern region countries, it may be easier to break through such barriers once friendly relations are established among the participating countries through exchanges. Universities and research institutions, as well as private research organizations, are encouraged to find partners and promote the exchange of information, material, and researchers. Moreover, a continual effort should be made to expand the circle of exchanges in the northern regions.

VIII. Swedish Arctic Science in International Perspective

Anders Karlqvist

Strictly speaking, Sweden is not an Arctic country. Applying standard geographical definitions, Sweden would not qualify, although it is situated at a latitude similar to Frobisher Bay or Fairbanks. Thanks to the warm Gulf Stream off the coast of Norway, Sweden enjoys a more temperate or subarctic climate.

Nevertheless, it is appropriate that Sweden participate in international discussions on Arctic science policy. Sweden can contribute, due to factors such as a strong tradition in polar exploration and research. Additionally, many of the attributes associated with the Arctic, such as cold, ice and snow, extended periods of darkness and light, as well as human aspects such as small dispersed populations, great distances and *remoteness*, are essential realities in northern Sweden.

Swedish Polar Research — A Brief History

Swedish interest in polar exploration began in the 18th century with the most famous Swedish scientist of all time, Carl von Linné (1707-1778). Linné travelled extensively in Sweden making scientific observations. He visited Lappland and documented his impressions of nature and life in the north. Several of his students became prominent explorers, both in the Arctic and in the Southern Seas. In the mid 19th century some remarkable scientific enterprises were undertaken in the Arctic. Sven Lovén (1809-1895), a marine zoologist, studied the marine fauna north of Norway and along the west coast of Spitsbergen. He inspired another young zoologist and geologist, Otto Torell (1828-1900), to go north. Torell's main interest was the theory of ice-ages, and he made expeditions to Greenland, Iceland, and Spitsbergen.

This pioneer epoch of Arctic exploration reached its peak with Adolf Erik Nordenskiöld (1823-1901), who led several expeditions to the Arctic. The most famous was his voyage with the ship Vega through the North-East passage in 1878-79. As a matter of fact, by the turn of the century most of the Arctic region, with the exception of Alaska and northern Canada, had been visited by Swedish expeditions.

Later, Swedish Arctic activities became more limited in scope, mainly focussing on the Svalbard area. Sweden played an active role in making the Svalbard treaty, signed in 1920, and ratified by the Swedish Government in 1924. A Swedish company was involved in coal mining at the Svea mine until the mid 1930s when the mine was sold to Norway (decided by only a one vote margin in the Swedish Parliament!). Scientific interest in the area has continued, however, although generally on a modest level. During the International Geophysical Year, 1957-1958, for example, a Swedish research station was operated at Kinnvika, Nordostlandet. The station still remains, but is used infrequently. It is in a remote and inaccessible location.

During the last few years we have witnessed a renewed Swedish interest in the Arctic, starting with the Ymer Expedition in 1980. This was the biggest Swedish expedition ever conducted. The icebreaker Ymer was used as a platform for research in the Arctic Basin between Frans Josef's Land and East Greenland.

Polar Research Stations

As pointed out above, the Arctic is not only a geographical area, but also denotes a set of geographical attributes and conditions. When speaking of Arctic technology or Arctic research, this is probably a more relevant perspective. Arctic conditions can be studied close to home. In Sweden's northern mountain areas, scientific stations are polar in character and yet still accessible and close to urban centres. The Tarfala station in the Kebnekaise mountains has been in operation for more than 40 years, and has served as a base primarily for glaciological work in Sweden. Abisko, which is located on the southern shore of Lake Torneträsk, 80 kilometers north of Kebnekaise, was founded in 1903, and since 1935 has belonged to the Royal Swedish Academy of Sciences. The object of the station is: "to provide Swedish and foreign visiting scientists with the opportunity of conducting scientific work based on the specific conditions of the environment surrounding the station and also to conduct such research with its own personnel." Investigations in many areas of the biosciences and geosciences are carried out at the station. Staff research emphasizes plant ecology and meteorology. In addition to these two field stations, the space research institute and the rocket launching facilities at Kiruna should be mentioned. This site provides a unique combination of a temperate climate, high latitude (68° N), and at the same time it is easily accessible and close to a large city.

The Northern Universities

The northern universities in Sweden play a prominent role in Arctic studies. The Technical University of Luleå has a special interest and competence in Arctic technology. The University of Umeå has, in addition to the arts and science departments, a medical and a dental school, and located on the campus is also the forestry section of the Swedish University of Agricultural Sciences. Although polar research enters into many different disciplines, it is probably fair to say that only a few institutions have Arctic science as their speciality. The Center for Arctic Cultural Research is an important focal point for circumpolar humanistic research with an emphasis on archaeology. The Center for Regional Development (CERUM), also at Umeå University, deals with the socioeconomic aspects of the north and plays a leading role in research on regional development in Sweden.

It is quite natural for these northern institutions to emphasize international cooperation and contacts with other research organizations around the polar circle. To some extent these ambitions can be regarded as a reaction against the academic center — periphery relations on the national level, where the old and prestigious universities in the south represent the traditional academic centers, and the young northern universities the periphery.

National Research Policy

The Ymer Expedition of 1980 has already been mentioned. It was the major Swedish research effort in the Arctic in modern times. In the aftermath of this expedition initiatives were taken to establish a permanent polar organization in Sweden. In 1984 the Swedish Government created a Secretariat for Polar Research. Its principal objectives are:

- to promote and initiate Swedish polar research
- to coordinate research efforts and to further international cooperation
- to serve as a focal point for information on polar research

The Secretariat for Polar Research is not a polar institute with laboratories and in-house research. In a small country such as Sweden, it is considered a wise strategy not to spread research resources too thinly. Therefore we have chosen to build on the university environment as much as possible. That is where most of the basic polar research should be done.

Polar research needs support from other sectors of society in order to justify its need for resources. In Sweden, as well as in other countries, there is a general political interest in polar affairs. The new U.N. Law of the Sea convention has profound implications for research and economic activities in the Arctic Ocean, with potentially undesireable effects for a country like Sweden which has no territorial claims in the Arctic. The implications of the Svalbard treaty and the Antarctic treaty for offshore operations are not yet clear. The resource regime negotiations and the discussions about the future of the Antarctic treaty system have undoubtedly spurred a great deal of political interest which has had a spillover effect on the Arctic issue as well. It is conceivable that the present concern for the future of Antarctica can appear as competitive to the Arctic activities. There is a threat at present that resources will be reallocated from Arctic to Antarctic research. For a country like Sweden where the overall effect seems to be more synergetic than competitive, the concern for Antarctica stimulates the interest for the Arctic as well.

A primary interest in the polar regions has to do with resources. Industry is looking for commercial opportunities. Swedish industry is certainly competent in various fields related to Arctic operations. In order to promote technical development in such fields, the Ministry of Industry has earmarked certain funds for research and development in Arctic technology especially related to offshore activities. Also industry itself has gradually become more engaged. However, industrial interests are not always easy to articulate. It is difficult to fit the notion of Arctic into the traditional organizational charts of industries and commercial organizations. Although there are very specific niches for Arctic products the real problems that face us in terms of resource management are systemic and call for a systemic combination of industrial competence and scientific knowledge.

In addition to political and industrial interests, there is another issue which has a high priority on the Swedish agenda, namely environmental protection. Environmental problems are important both when seen from a global perspective with such questions as climatic change, and when seen from a regional or national perspective, with the concern for acid rain, oil spills, etc. There is no doubt that the polar regions play a key role in dealing with such matters.

If we were to outline a Swedish strategy for polar research, a leading theme would be the environment, for it is a field where our political concerns, industrial competence and scientific expertise overlap. More explicitly, interest would focus research on subjects such as atmospheric chemistry, and especially the study of aerosols and carbon dioxide, as well as on other scientific issues focussing upon present and past changes in our environment and climate.

Research Cooperation

An important strategy for our polar research efforts is to encourage cooperation with other polar nations. This idea is based on the recognition that we can play only a marginal role in the overall international research world. For us the natural starting point for international cooperation is the Nordic countries. Of course we do have a long experience to build upon in that respect. As an example, the Swedish research activities in Svalbard have consistently been carried out in close collaboration with the Norwegians and Norsk Polarinstitutt. The new organizational framework for polar research which is now emerging not only in Sweden but also in Denmark, together with the interest shown by various Nordic organizations will certainly help to promote such cooperation even further.

The cooperation with our Nordic neighbours can be a useful stepping stone toward a more extensive regional cooperation. We all know the difficulties involved in working together in an area which is politically sensitive and where the two super-powers are facing each other across the Arctic Ocean. It is important to strengthen the confidence in the area and to develop a closer contact with Soviet scientists. No truly regional problems can be properly addressed until data between all sectors of the Arctic can be made available and exchanged between scientists in different countries. Existing bilateral agreements such as the one between Canada and the U.S.S.R. might be a good platform from which to build. Neutral countries such as Sweden and Finland might also be able to play an important intermediary role between East and West.

So far not too much practical progress has been made in circumpolar research collaboration. International organizations like Comité Arctique International, the Arctic Ocean Science Board, and the MAB-Northern Science Network seem to have difficulty in attracting a serious involvement from the Soviet Union. The situation is obviously much more complicated in the north than in the south. The Scientific Committee for Antarctic Research (SCAR) functions as a very successful umbrella organization for Antarctic scientists from all parts of the world. A similar arrangement has been considered for the Arctic. It does not seem to be a very realistic proposition at present.

We should not, however, be totally preoccupied with the political obstacles. There are other more practical and simple difficulties to cooperation which also have to be faced. Arctic science is a small part of international science. The personal resources are scarce. We cannot expect our comparatively few scientists to leave their real jobs too often to go to planning meetings and conferences. The return from such activities is not always found worthwhile. Cooperative organizations must not become a goal in themselves.

We often talk about the regional disadvantages of the Arctic as a region with a small and dispersed population, long distances and costly means of communication, all of which hamper economic and social development. Actually, the same type of reasoning holds for science itself. We could as well apply our regional theories on the activity of Arctic research. The critical mass of research in terms of people and money is hard to attain. The costs of establishing and maintaining an active circumpolar network like this one are high compared with those in more densely populated research areas.

The Role of Polar Research in the Context of International Science

We can also view Arctic research from the perspective of the regional center — periphery model. It is a well recognised and widely discussed problem that the future of the Arctic regions, including its research, is dominated by people and power groups outside the regions. We need trained people who come from the north, who are living in the north and who can participate and become leaders of research activities which influence the development of the Arctic.

However, there is also another facet of this center-periphery dilemma which is less noticed but from a scientific point of view equally problematic. Polar science is not traditionally a core activity in the leading scientific disciplines. Particle physics, molecular biology, mathematical economics, etc., occupy the most prestigeous positions in the scientific world, not natural geography or biological taxonomy. This is not only a superficial matter of scientific ranking. It actually concerns funding of research and recruitment of talented young students who are going to carry the responsibility for research in the future.

Compared with many other sciences, polar research has by and large been a very traditional field biased in favour of description and basic empirical investigation rather than theory and sophisticated measurement. The old picture of polar exploration with heroic men (of course, no women) traversing the wilderness making important observations of whatever they could see and measure has not completely left our minds.

We are, however, in a period of transition from traditional to modern science. New sophisticated methods from nuclear physics, computer sciences, etc., are fertilizing old traditional fields such as geomorphology and glaciology (and even the humanities such as archaeology). These new ideas will most likely have a profound influence on Arctic science. It is vital that we attract leading scientists from the core of their disciplines to become involved in polar research. We should also realize that the more mature the science of the north becomes, the more relations will be established between Arctic and non-Arctic science and the less exclusive will the concept of Arctic become in scientific terms.

The polar areas will still be important globally. A close look at what happens in these extreme regions might give the clue to understanding triggering effects for global changes and give us early warnings so as to avoid environmental surprises on a large scale. The Arctic will more and more be regarded as the crucial link in the analysis of regional or global problems.

In other words, there are two different forces at play in Arctic research: one which emphasizes the localization of Arctic research in the Arctic and by Arctic people, thereby promoting the identity and autonomy of the Arctic in relation to the south; the other which stresses the universality of science, thereby diminishing the exclusiveness of the Arctic and reducing its role to provide special aspects of more comprehensive theories. These two tendencies might not be easy to reconcile and could be a source of future problems in research policy making.

IX. Norwegian Arctic Science Policy

Arnoldus Schytte Blix

The views expressed in this paper are not those of the Norwegian Government. They represent the personal opinion of the author, on matters of personal interest.

The Norwegian mainland covers an area which is about 50% of that of Texas, or 20% of that of Alaska, while the population in Norway is comparable with that of San Francisco. On the other hand, Norway has sovereignty or claims to additional land areas extending from 81° N latitude at Svalbard, to almost 90° S latitude in the Antarctic, covering an area comparable in size with Greenland, or twice the size of Alaska.

Given this information, it should be quite obvious that our investment in polar science per square meter of polar possession has been, and will probably continue to be far into the future, rather small. In fact, large parts of our possessions are, at the present time, poorly mapped or not mapped at all, not even topographically. In this situation one could argue that an overall national polar science policy would be imperative.

In Norway there are a number of agencies with an interest in and the potential for identifying priorities and creating policy. The National Committee for Polar Research in Norway is unusual in that it is not only aimed at Antarctica and cooperative work under SCAR, but it is also concerned with research in the Arctic. The National Research Council for Science and the Humanities has put much emphasis on polar research and includes a permanent subcommittee on polar research. The latter agency has made an attempt to identify research priorities and to suggest a research policy, but neither agency commands funds to implement or even direct an overall national research policy. This raises the question of where the money, and hence the capability of implementing a research policy in Norway, is to be found today.

There appear to be two major sources of funding: one is the Technological Research Council, which commands a major portion of all federal money allocated for non-governmental research in the country; and the second is the oil companies, which increase in strength and importance day by day in Norway. Since the major part of Norwegian state revenues come from the oil industry, it is only natural that both sources put their priorities on promotion of technological development aimed at the exploitation of oil and gas resources. And with this very important, but rather narrow field of interest, non-technological research — even basic science related to assessment of the impact of the technological development on renewable resources — suffers. Moreover, with regard to Arctic research, the search for oil and gas has only recently moved into the Arctic regions (i.e., Svalbard and the Barents Sea, where Norway shares an extended and disputed common border with the Soviet Union).

In consequence, the Technological Research Council and the oil companies which have the means to implement research have so far not shown any great interest in the Arctic. In fact, the Technological Research Council has until this day no polar sub-committee, nor other tokens of interest. It is very likely, however, that the interests of both Norwegian research agencies and government to an increased extent will focus on the Arctic and that the development of a national Arctic research policy will follow in the near future.

In the meantime Arctic research in Norway is carried out on a broad scale, but on a more or less *ad hoc* basis, by numerous university institutions, with a very significant tradition and capability, but suffocating from lack of funds. A number of oriented management federal agencies, like the Fisheries Research Institute under the Ministry of Fisheries (to some extent comparable with the U.S. National Marine Fisheries Service), the Institute of Meteorology, and the Norwegian Polar Research Institute under the Ministry of the Environment, are also contributing very significantly. The latter of these agencies is an inter-ministerial research and advisory institution which is a major stock-holder in Norwegian Antarctic research, but is also primarily aimed at the assessment and management of the natural resources of Svalbard. Norway has a special commitment to Svalbard, since this High Arctic archipelago is indisputably part of Norway, a commitment which was further developed with the creation of a number of national parks and national reserves. Svalbard is also a very important denning area for polar bears, and is biologically unusual in that rodents and mosquitoes are almost non-existent. In fact, Svalbard is special to the Norwegian Government, both for the previously mentioned reasons, but also because it is readily accessible due to frequent commercial air service and a relatively comfortable climate. This makes it possible to bring ministers and other influential people to the area to experience the beauty and the problems there first-hand.

The emphasis on Svalbard in Norway is also reflected in the recently completed Man and the Biosphere Programme, which in Norway has by and large been concerned with studies of the Svalbard reindeer. To put the emphasis of Norwegian polar research in perspective, however, it should be mentioned that the Norwegian contribution to this MAB Programme has been in the order of 1.2 million dollars over a 10 year period, and that prior to 1983, this was the biggest single Arctic biological programme in Norway. In addition, Norway has a history of pursuing international cooperation in solving Arctic problems; problems which are to a great extent common to all circumpolar nations and also concern a number of nations located outside the Arctic. In this context, Svalbard should be an area of particular interest to those concerned with basic science due to the lack of political complications related to conducting research in the area.

In conclusion, regardless of national means and capabilities, increased international cooperation in the Arctic should be a policy of all nations concerned (in fact this may become imperative), since it is to be expected that many countries, particularly the smaller ones, will shift money away from the Arctic to the Antarctic for many years to come. It is hopeful that networks such as this can contribute to the exchange of ideas and implementation of Arctic research to the benefit of mankind.

X. Arctic Science Policy and Development from the Point of View of a North Norwegian University

Per Mathiesen

The University of Tromsø is probably *the* northernmost university in the world. The intention of this paper is to present the University to the community of northern scholars and politicians and inform them of the existence of the University in the northern hemisphere. The views expressed here represent those of the University of Tromsø, and not the Norwegian Government. Indeed, the opinions expressed may not necessarily be in agreement with those of the University Board of Tromsø, of which the author has had the pleasure of being a member for the past 2 years. As the title of this paper indicates, the three main points of orientation are that of a *university*, specifically a ***Norwegian*** university, and lastly, a ***North Norwegian***, if not an Arctic, university.

Norway has a location on the globe similar to that of the state of Alaska. Both territories stretch from somewhere south of the 60° N latitude (excluding the Panhandle), and the mainland reaches just north of 70° N latitude. Compared with the southern hemisphere, everything on the polar side of 60° S latitude in the Antarctic is covered with ice. So in relation to the Antarctic, both Norway and Alaska are relatively favourably located, climatically speaking and otherwise.

Additional comparisons between Alaska and Norway may be drawn. The part of Norway which lies north of the Arctic Circle (i.e., 66° N) has a population of approximately half a million people. The area north of 70° N latitude, which runs just a few miles to the north of the University of Tromsø campus, supports a population of about 130,000 people, including the town of Tromsø. This relatively high population density is possible due to the Gulf Stream and the North Atlantic Drift, which sweep along the coast of Norway with the result that no harbours or fjords on our western and northern coastline freeze in the winter time. In other words, half a million people, comprising one-eighth or 16% of the total population of Norway, are located in a territory which could be considered an Arctic region. This settlement pattern is an anomaly resulting from warm ocean currents, and in this manner Norway, particularly in its north, is an anomalous society.

The fact that the Arctic part of Norway is *not* an uninhabited barren region but constitutes an exception in this climatic sense, and is further enhanced by the existence of oil and gas in the North Sea, explains why large-scale developments are carried on in the north. Having a large "Arctic" population, bordering on the Arctic Basin, and having a long tradition of Arctic research, North-Norway has a rather unique position from which to follow the Arctic debate. The University of Tromsø now wants to take an active part in this debate. There are, however, political overtones and implications on a scale that is beyond the scope of this paper. For instance, an attempt is presently underway to set up a new constitutional arrangement for the indigenous people of Norway, the Sami; however the progress is slow, lacking in any large-scale public debate and without substantial innovations.

With an Arctic population of approximately half a million people, Norway has a duty to ensure that development and research in the North is carried out with an anchoring point in the people who *live* in the North. For Norway this means the Norwegians and our indigenous people, the Sami. For the other countries bordering on the Arctic, it means focussing on the indigenous people of the North, and to a lesser degree also on the white man, the colonizer of the North.

This position is taken because it seems to be *just* and the strategy which in the long run will be the most logical and obvious solution to a very serious political dilemma. This view was also supported by the Third National Workshop on People, Resources, and Environment North of 60°, which in 1983 urged those with a concern for this matter to take a stance, presumeably not just any stance. In his introduction to the book published after the workshop, the chairman of CARC, Dr. Everett B. Peterson writes:

> "In the last decade Canadians sought to answer *how* to manage development of northern resources; in the present one we shall debate *who* will have that responsibility." (CARC 1984:xiii)

It is the hope of this author that planning and utilization of the North be carried out with reference to the indigenous peoples of the North, and eventually by the people of the North, if it is found to be necessary and advisable.

Further argument will not be pursued here. These normative statements are in agreement with opinions expressed by the former Canadian minister of Indian Affairs and Northern Development, the Honorable John C. Munro, speaking at the CARC workshop in Yellowknife 2 years ago:

> "At a time when our country is struggling to redefine itself, to determine what kind of a future we want for everyone in this land, we must in all fairness pay particular attention to the needs and aspirations of Native people without whose good faith and support we cannot fulfill the promise that is Canada." (CARC 1984:58)

It is important to stress that the "needs and aspirations of Native people" include the question of political needs just as much as anything else.

To digress, one observation concerning the question of who were the first people to utilize the Polar regions is that whenever territorial rights and duties in the Antarctic are discussed, Norway and a handful of other states base their claims on the fact that they were the first states to set their foot on the South Pole or some similar place. In other words, Norway and other countries claim to have the rights of indigenous people in the Antarctic, at least implicitly. It is no accident that Norway sent its largest expedition ever to the Antarctic only last winter.

There is a lack of consistency here. When turning to the Northern hemisphere, Norway and other states around the Arctic Basin tend to reject the claims of indigenous people, who really were here and lived here before the white man. In this context one tends to argue that it is the *totality* of the society which is the proper proprietor of the Arctic resources. Admittedly, there are weaknesses in this comparison, but it is not without its merits.

Arctic research and developments must primarily be aimed at strengthening the position of the people of the North, particularly the indigenous peoples, the Inuit, Sami, Greenlanders, and Indians, to name the westerly groups. This is because the future status of these indigenous peoples is one of the most serious and challenging issues of our time for the Northern hemisphere, and consequently for the Northern peoples. Their situation is characterized by a deep and serious need for autonomy, not only politically but in all aspects of the word. Such political processes are counteracted by many factors, economics being not the least important. The potential quantity of resources in the North, the oil, uranium, fish, whales, etc., when developed with reference to the economic needs of the people who live around these waters, can provide what is necessary to establish and maintain autonomy in the North for peoples of the North.

Obviously such claims might sound totally irresponsible. The intention in bringing such ideas forward, however, is to highlight an overarching principle for the utilization of the resources of the Arctic. This is done because the actions of the UNESCO/MAB Northern Science Network are of great concern to us at the University of Tromsø and we want to take part in the shaping of the network and its future functions.

Two comments on the workings of the Network are offered here, one concerning the present, and one dealing with the future. First, the present situation: based on a reading of the *Northern Science Network Newsletter*, the feeling is that so far too much attention has been focussed on micro and eco-relations in the Arctic and too little on the macro-structure of the total situation of the *peoples* of the Arctic. Put differently, too much of the attention of the Network has been concentrated on interdependencies between nature and nature and between nature and man, while much less energy has been allocated to the very complex relationship between *man and man, and nature*, that is, how the indigenous societies fare in the contemporary world.

This then, should also be an objective of the Network. According to the published summary of the founding meeting of the Network, held in Edmonton in 1982, the Canadian delegation is reported to have "... stressed the man-centered orientation of MAB activities, as contrasted with the earlier IBP science-centered concerns."

The vision of a "man-centered" focus for the Network would include not only the three very pertinent themes which have so far dominated, and seem mainly to touch upon the ecology of the indigenous peoples, but should also include consideration of their present *political ecology* or *organizational habitat*. Information about the political development of the peoples of the North in a comparative perspective requires to be better circulated. In that manner, we could measure the effectiveness of the Network, assuming that it is the welfare of the peoples of the North that is our primary concern. The information which has been circulating thus far is too fragmentary, too minute and lacking in focus to really be able to accumulate the type of knowledge which could help up in reaching our goals.

The question is, how can new themes be introduced into the Network? According to the *Newsletter*, Vol. 2, No. 2, Dr. Fred Roots reported from the Eighth Session of the MAB International Coordinating Council that:

> "The Network is a vehicle for exchange of ideas and information, and a generator of new ideas. Other themes will be carefully considered, and embarked upon only if they are:
>
> - well-focussed, and the questions that they are designed to answer are clearly understood by all;
> - are such that they will contribute to the advance of science and knowledge and the application of that knowledge to social and economic problems of the region;
> - can be participated in by the resident people of the region;
> - and benefit from the contributions and participation of two or more countries." (Roots 1984:15)

The new theme proposed here should be formulated along the following lines: "*New Constitutional Arrangements in the Political Organization of Arctic Peoples — a Comparative Perspective.*"

There is no reason to doubt that the *political* ecology of the peoples of the Arctic is seminal to their future development and to their cultural survival.

There is a substantial amount of information to be circulated. To use the example of the Sami of the Nordic countries, and particularly in Norway, the Norwegian Government has only recently begun the preparation of a report to parliament on the opinions which have been presented to them regarding the first report of The Norwegian Sami Rights Committee. This Committee has been asked to look into two questions:

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1. Will it be useful for Norwegians and Sami alike if a special paragraph is introduced in our constitution concerning the obligations of the State versus the Sami in Norway?

2. Will it be useful for the Sami to have their own Parliament which could give advice to the national Parliament, the Storting, on Sami matters when there is a need for it?

The Sami in Finland have for some years had their Sami Parliament. What have been the results of such an innovation? The Sami of Sweden do not have any such parliamentary arrangements. What is currently being contemplated along such lines? What has been the experience of "Home Rule" in Greenland? What sort of knowledge have the Greenlanders acquired about their present parliamentary arrangements so far? What has been the experience of the James Bay and Northern Quebec Agreement? What has happened so far with the Invuialuit Final Agreement of 1984, and the Dene, Yukon Indians, and Inuit of the Eastern Arctic after their years of negotiations?

The list of relevant topics could be made much longer. What is more important is that we are faced with a series of political questions of great complexity which *might* be brought closer to their solution if those involved, Natives and colonizers alike, have a comparative insight in minority/majority relations throughout the Arctic. If the Network had been in the position of being able to launch research projects, ***Comparative minority studies*** would have been suggested. Now this author can do no more than bring the notion forward.

It is not only because Norway is a country bordering the Arctic that the types of development outlined above are urged. It is the simple fact that priority in the development of the North must be given to those who first inhabited it, to those people who still live in the Arctic, to those who first arrived there. No other principle will lead to a peaceful utilization of the North in the future.

To conclude, I suggest that a fourth MAB Science Network Theme be considered, to be entitled *The Political Ecology of Circumpolar Peoples*. The objectives of this theme are to examine:

a) The policy and political frameworks within which native peoples and nation states function and interact.
b) The use and occupancy of circumpolar lands by native peoples.
c) The manner in which native peoples can manage circumpolar lands and resources in conjunction with national, regional, and local governments.

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XI. Perspectives on the Development and Utilization of Living Resources in Heilongjiang Province, P.R.C.

Ma Yi-ching

Heilongjiang Province lies along the northeastern border of China, between 121°11' and 135°5' E longitude and 43°25' and 53°33' N latitude. It has an area of 460,000 square kilometers, over 50% of which consists of mountainous areas. In the northwest are the Da Xingan Ling Mountains, to the north are the Xiao Xingan Ling Mountains, and in the east and southeast are Zhang Guangchai Ling Mountain and Laoye Ling Mountain which are in the northern part of the Wanda Chan Mountains and Changbai Shan Mountains. The province has three large plains formed from river and lake alluviations, Songhuajiang Nenjiang Plain in the west (110-150 meters above sea level), Sanjiang Plain in the northeast (only 50-60 meters above sea level), and Xingkai Plain. Each of the three large plains includes large areas of moist marshlands. The weather of Heilongjiang Province has the remarkable characteristic of a continental monsoon climate. The average yearly temperature is relatively low, and the winter is bitter and long. The province, with the title of the "North Pole of China," is the coldest province in the whole country. In the coldest month, average temperatures reached -52.3° C (February 13, 1969, Mohe), setting a national record.

Natural conditions of this province vary and the great diversity of fauna and flora reflect the natural and geographical characteristics. The rich wildlife resources provide good conditions for the development of local agriculture, forestry, animal husbandry, and fishing and hunting industries.

There are more than 2,100 species of higher plants in Heilongjiang Province. Three distribution areas can be defined according to floral composition and origin: Siberian flora of the Xiao Xingan Ling and Laoye Ling Mountain area, Changbai flora of the Da Xingan Ling Mountain area, and Mongolian flora of the Songnen Plain area. Four hundred and fifty-seven species of these plants have been economically exploited (see Table 1).

Table 1. Statistics on the use of botanic resources.

Number of Species Utilized

Area *Use*	*Whole Province*	*Da Xingan Ling Mountain Flora*	*Xiao Xingan Ling and Laoye Ling Mountain Flora*	*Songnen Plain Flora*
Wood	68	16	47	5
Chinese medicine	497	92	257	146
Food stuffs	371	102	139	130
Oils	130	32	66	31
Edible wild herbs	126	32	60	34
Nectar sources	33	67	20	124
Fibre	17	59	34	110
Tannin	27	57	18	102
Fertilizer	20	38	26	84
Starch	16	33	25	74
Wild fruit	15	30	8	53
Perfume	12	23	14	49
Afforestation	4	20	7	31
Rubber	4	7	6	17
Resin	3	8	3	14

(Data from Zhou, R.C., 1985.)

There are approximately 610 species of vertebrates in Heilongjiang Province. Among them, 97 are fishes, 12 are amphibians, 14 are reptiles, nearly 400 are birds, and 87 are mammals. Compared with those in other provinces, animals in Heilongjiang Province have the following characteristics:

(a) In terms of zoo-geography, the majority of species are northern. Some mammals with a circumpolar distribution occur in this province, such as reindeer (*Rangifer tarandus*), moose (*Alces alces*), snow hare (*Lepus timidus*), wood lemming (*Myopus schistcolor*), and wolverine (*Gulo gulo*). Of the birds, many migratory birds breed in the Province, such as the whooper swan (*Cygnus cygnus*), common crane (*Grus grus*), mandarin duck (*Aix galericulata*), gray heron (*Ardea purpurea*).

(b) In terms of size, large species are in the majority. Of the mammals, more than 20 species are carnivores, accounting for over 50% of the national total. Most of them are precious fur-bearing animals, such as sable (*Martes zibellina*) and stoat (*Mustela erminea*). Similarly, of the birds, non-passerine species account for over 40% of the national total. Many of these are of economic value, such as the small-billed capercaillie (*Tetrao parvirostirs*), hazel grouse (*Tetrastes bonasia*), and great bustard (*Otis tarda*), etc.

(c) In terms of ecology, animals in this Province have remarkable seasonal characteristics and cold-resistant adaptations. Apart from those having long hair and thick down, some other species of animals fit in with the snowy environment because their coats become white in winter, such as the snow hare, stoat, least weasel (*Mustela nivalis*), and birds like the snowy owl (*Nyctea scandiaca*), and snow bunting (*Lagopus lagopus*). Some animals spend the winter in hibernation, such as the hedgehog (*Erinaceus europaeus*), Siberian chipmunk (*Tamias sibiricus*), Daurian ground squirrel (*Spermophilus dauricus*), etc. Large or mid-sized mammals, such as the badger (*Meles meles*), racoon dog (*Nyctereutes procyonoides*), brown bear (*Ursus arctos*), and black bear (*Selenarctos thibetanus*) also spend the winter in hibernation. However, many birds migrate a great distance to the south to spend the winter.

Table 2 summarizes the exploitation and utilization of various species of wild animals.

Table 2. Statistics of Protected or Utilized Animal Species

Use Status	*Fish*	*Amphibians*	*Reptiles*	*Birds*	*Mammals*
Protected species	4	-	-	30	14
Fur or feather	-	-	-	61	35
Chinese medicine	11	7	11	27	36
Wild game	-	2	1	62	16

Among the protected species, the manchurian tiger (*Panthera tigris*), the sika deer (*Cerrus nippon*) and two other species have been listed as the first class protected animals in the country; sable (*Martes zibellina*), red deer (*Cervus elaphus*) and eight other species have been listed as second-class protected animals; fifteen species of bird such as red-crowned crane (*Grus japonensis*) and white stork (*Ciconia ciconia*) are first-class protected birds; and another fifteen species of bird such as whooper swan (*Cygnus cygnus*), white-fronted goose

(*Anser albifrons*) are second-class protected birds. On March 3, 1981, the Chinese and Japanese Government delegations signed the Sino-Japanese Agreement on the Protection of Migratory Birds and their Habitats. According to the Agreement, 227 species of migratory birds are under the joint protection of China and Japan. From 1982 onward, a love-bird-week movement is carried out throughout China every spring, at which season most birds breeding in the spring are under universal protection. To develop the movement of love-birds and love-nature, the swan has been designated the provincial bird of Heilongjiang Province, with the approval of the provincial government. Fish protection is mainly carried out by means of setting up protective areas for the spawning of some species of salmon (*Oncorhynchus* spp.).

The fur of such animals as the Siberian weasel (*Mustela sibirica*) and muskrat (*Ondatra zibethica*) are important products with several hundred thousand pelts produced every year. The utilization of bird's feathers is mainly restricted to the flight feather and tail feather of birds of prey, which activity has stopped in recent years because of love-bird movements. The utilization of feathers of various wild geese and ducks, with the development of planned hunting, still continues on a small scale.

Deer raising has a long history. However, large-scale raising in large deer farms has been developed only after the founding of New China. Deer raised in farms are mainly sika deer (*Cervus nippon*), accounting for 80%, and red deer (*Cervus elaphus*), which accounts for 20%. The aim of raising deer is to acquire antler for medicine and for export to Southeastern Asia and Japan for foreign exchange.

Fur-bearing animal ranching has developed greatly in recent years. Apart from mink (*Mustela vison*), key animals raised are racoon dogs and domestic hare, that are mainly raised in cages or huts. In recent years, local wild animals such as the Siberian weasel, steppe polecat (*Mustela eversmanni*), and muskrat have also been domesticated.

Since the founding of New China, Heilongjiang Province has been a national hunting base. It produces a considerable amount of wild fur, wild game, and medicinal animal products. However, living resources are diminishing with every passing year because of habitat alteration and poor management. For example, the population of bear has been markably reduced in recent years (Figure 1). Therefore, the hunting industry in Heilongjiang Province has entered into a new stage beginning in the late 1970s with the goal of wildlife protection. The priority was to save animals on the verge of extinction and to implement the policy of the State to "strengthen protection of resources, actively tame, raise and reproduce animals, and rationally manage and use them." Heilongjiang Province has developed public education movements to protect wildlife and to save rare and endangered species, and has actively formulated and carried out a set of measures to protect and manage wildlife resources. Up until 1984, nine natural reserves have been established to protect wildlife and its habitats (see Table 3). From 1980 onward, hunting has been completely forbidden within five areas and cities in key forests, and strict regulations and a system of rewards and penalties have been established to regulate hunting and the sale of hunting products in the Province, and to manage wildlife resources. Meanwhile, scientific study and research on wildlife and wildlife raising have been encouraged and advocated. However, the management of hunters in the Province has yet to be resumed.

A new aspect of the hunting industry of Heilongjiang Province has appeared in the 1980s. In line with the State policy to stimulate the domestic economy and to open China to the outside world for the enrichment of the country and the people, the first wildlife raising and hunting place in the country, covering 21,000 ha., was established in the Taoshan area of Yichun City, Heilongjiang Province, with the approval of the Forestry Ministry in 1981. In 1984, it opened to the outside with the approval of the State Council. In the autumn of the same year, the Province received the first hunting tourists from an American travel service, thereby successfully initiating a service to foreign hunters. This method not only protected the wildlife resources of Heilongjiang Province, but gained foreign currency for the country. What is more, we have had the benefit of foreign country's advanced experience in hunting.

Agricultural production is essentially the transformation of animals and plants into capital for the benefit of human beings. Crops and domestic animals are related to people in a close way, but are still subject to biological laws, e.g., growing (providing products) and reproducing (renewing resources) according to environmental conditions concerning lands, water and weather that provide nutrients and energy. Therefore, in the development of modern agriculture, not only the planting of crops and raising of livestock should be taken into account, but modern techniques should be effectively and scientifically applied to the management of lands, water, weather, and living resources to improve the whole area of cultivation. In this way, people will make full use of the environment to acquire high-quality products for the needs of human beings, and in addition, the ecosystem will reach a new balance which guarantees the best conditions for the renewal of those resources. This knowledge must be used by wise agriculturalists who want to ensure effective and steady production. Chinese agriculturalists have now realized this problem, and are working hard to achieve this goal.

Table 3. Natural Reserves in Heilongjiang Province

Name	*Location*	*Area (ha.)*	*Key protected resources*
Fengling Natural Reserve	Wuyeng and Yichen City	18,400	Korean pine (*Pinus koraiensis*) seed forest
Zhalong Natural Reserve	Qiqihar City	42,000	Water fowl such as cranes and their wetland ecosystems
Jingbohu Lake Natural Reserve	Ningan County	120,000	Water-maintaining forest and underground forest
Wudalianchi Natural Reserve	Dedu County	70,000	Volcanic remains and natural landscape
Qixinglazi Natural Reserve	Huanan and Jixian Counties	33,000	Manchurian tiger (*Panthera tigris*) and its habitat
Mudanfeng Mountain Natural Reserve	Mudanjiang City	40,000	Forest ecosystem
Liangshui Natural Reserve	Dailing Mountain	6,394	Korean pine primitive forest
Heilonggong Natural Reserve	Shangzhi County	3,600	Forester frog (*Rana amurensis*) and its natural environment
Honghe Natural Reserve	Tungjiang County	31,200	Marshland, waterfowl and their habitat

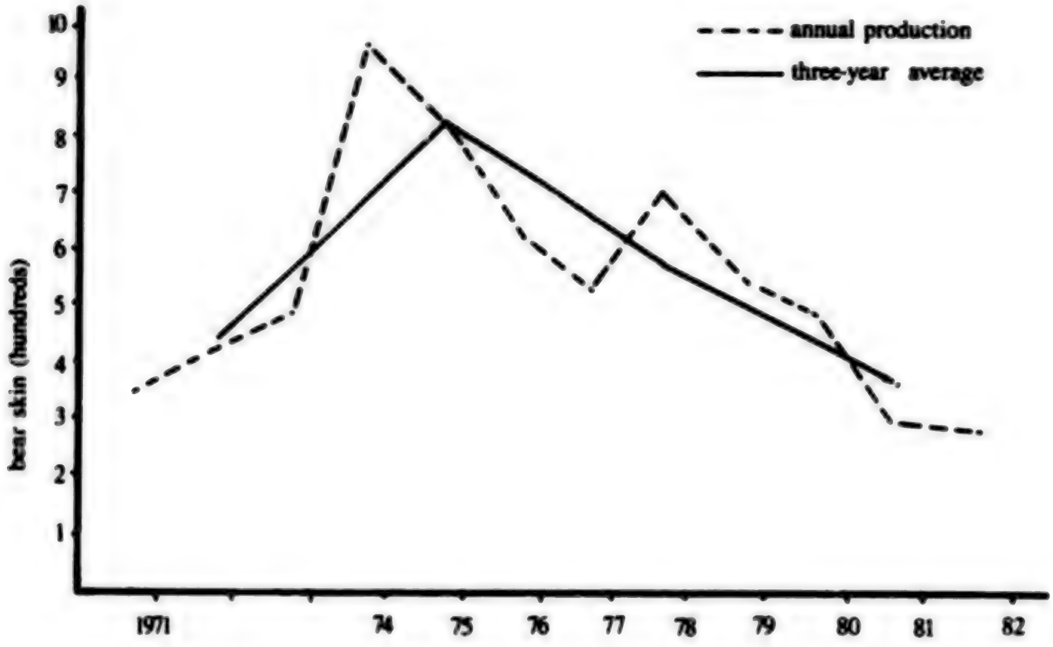

Figure 1. Change trend of bear population in Heilongjiang Province

Figure 1. Change trend of bear population in Heilongjiang Province.

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XII. Science and Development: A Management Problem.

John J. Kelley

Economic, social and political developments in Arctic regions, particularly in Alaska, have accelerated greatly in the past decade. There are indications that they will continue to do so. As a result of this development there has been a need for an expanded, coherent, and sustained body of scientific knowledge of Arctic regions, processes, and resources on which to base economic decisions, socioeconomic development, and environmental protection policies, as well as defense or security considerations (National Academy of Science 1981).

As a result of this situation, scientific research is a necessary prerequisite to effective and responsible policy formulations in the Arctic (*ibid.*). Often it is the other way around. The limits to which science can serve as an instrument of policy also are quickly reached (Griffiths 1979). So also are the limits of possible environmental cooperation in the circumpolar north. However, where knowledge about the Arctic environment is greatly lacking compared to other regions, and where the ability to conduct scientific research is severely hampered by logistical factors, then scientific research becomes both a basis for effective action and a necessity for the eventual well-being of the inhabitants of the region. Although the primary work of advancing knowledge is generally carried out by a small group of investigators, the benefits are uniformly applicable to all citizens. However, the ability to conduct research has and will present a number of management problems.

The Arctic is not restricted to the Alaskan Arctic, but occurs within a circumpolar setting. To be properly adapted to this setting, policy must begin with a recognition that the Arctic environment is in many respects indivisible and requires a strong element of integration. Native peoples of the Arctic regions, particularly the Inuit, have already recognized that national boundaries are alien to an indigenous view of the Arctic. After all, there is a physical interconnectedness throughout the circumpolar environment. It seems only reasonable and desirable to encourage circumpolar Arctic nations to act together as much as possible as collective stewards of the region (*ibid.*).

It will be very difficult for any one nation to take on the task of addressing adequately all the numerous scientific problems and issues relevant to their Arctic areas. These needs are enormous as evidenced in part by the studies conducted by the National Academy of Sciences relevant to the U.S. Arctic Research and Policy Act and the North Slope Borough's identification of the major scientific and research needs that are likely to be of greatest concern to them in the next few years (Kelley 1985). However, there are broad categories of scientific and technological needs which must be recognized as policy decisions are being made.

There is a need for long-term data in just about every discipline. Although monitoring activities are presently considered unfashionable, without them we run the risk of missing important events or trends. A long-term commitment to monitor selected or key environmental variables and systems is necessary to more effectively establish criteria for the development of mitigative measures. There is also a need for more research on fundamental process studies in the Arctic as well as the development of appropriate technologies for these regions. I suggest, however, that the traditional separation of basic and applied science be modified in our thinking. I can only suggest the wisdom of Pasteur: "There are not two sciences; there is only one science, and these two activities are linked as the fruit is to the tree." Occasionally the importance of one versus the other gets confused.

Effective information exchange is vital whether it be at the local, national, or international level. This is especially important because in Arctic areas, the economic, social, environmental, and defense issues are much more intermixed. Despite the stated need for an acceleration in the growth of Arctic research, there has already been a staggering growth of both formal and informal publications. These publications result from the research efforts of industry, public agencies and academic institutions. It will become an increasingly important management task to provide for timely synthesis of Arctic environmental information not only in Alaska but on a circumpolar basis. This is not to say that nothing is being accomplished in the way of environmental information synthesis at present. Various international scientific unions and working groups are engaged in specific tasks along these lines. It is important that information from all research sectors (government, industry) be considered and be made available in a form that is useful to decisionmakers and planners. The latter is easier said than done and will require considerable thought and not just the generation of yet another report or publication.

The high cost of support for science in the Arctic is not a trivial matter. It is a crucial management problem. Northern studies are certainly put at a disadvantage compared to the conduct of research in non-polar regions. The approach to a solution is a difficult one. There are the short-term needs of industrial and corporate research as compared to the long-term research needs of others. Logistic support for science varies widely depending on the urgency of the mission, availability of funds and other considerations.

Our efforts in the Arctic have been characterized by steadily growing scientific interest and occasional bursts of activity. Efforts to conduct research on ice-covered seas have been handicapped by the lack of available ice-working research ships. Our national fleet is notably deficient with respect to ice capability, especially when compared to other countries such as Canada and the Soviet Union. Our Coast Guard icebreakers are committed primarily to other missions and are unsuitable for many scientific purposes. The need for research platforms operating in seasonal sea ice and in high-latitude open oceans is widely appreciated in the national oceanography community. Much ice-related research can be carried out with satellite imagery, long-range aircraft, submarines, remote sensing and drifting ice-stations. However, much of the important research which will be required can be accomplished most effectively from an ice-strengthened, stable research vessel (Elsner and Leiby 1980).

In Alaska, short-term solutions to research support needs have been carried out at temporary advance bases or staging areas. After the closure of the Naval Arctic Research Laboratory (NARL) a major focal point for the support of scientific research disappeared. The fact remains that there is a greatly increased long-term need for a wide variety of scientific and engineering information that can best be addressed at a central facility located in the Alaskan Arctic. Such a facility properly organized can serve the multi-disciplinary needs not only of Arctic Alaska, but can interact and cooperate with other circumpolar nations. A polar research and support center located outside of the Arctic is clearly to be discouraged. The subarctic regions of Alaska contain not only large population centers, but a substantial number of industrial government agency headquarters and industrial organizations. It has been relatively easy therefore, to address research and development problems more effectively in Alaska's subarctic interior than within its remote Arctic land and oceanic regions. The need for a multi-purpose subarctic laboratory capable of providing logistic support is somewhat diminished in contrast to the need for one on the North Slope. The formulation of any research policy must certainly take into account how the logistic support for science and engineering projects will be handled.

Sponsorship of an Arctic Research Laboratory (ARL) by a mission-approach agency, either Federal or State, is likely to result in future conflict as the emphasis of the mission changes. This would further in a situation similar to past problems at the NARL. Whether the sponsor is Federal, State, or a private organization, the intent should be for the long-term maintenance of an economical, continuous, and stable situation within which the ARL can achieve its goals. There should be sufficient flexibility in the laboratory's charter to afford effective response to new research directions in northern Alaska and the adjacent Arctic Ocean. The laboratory should be organized to accommodate the varying needs of the private sector, government and academic institutions.

The functions of an ARL should incorporate:

1. Provision of logistic support and staging for both land and drifting-station projects.
2. The implementation of research and monitoring activities.
3. Contribution to the education and training of the residents of the region.

The mere presence of an Arctic Research Laboratory does not make contributions to the advancement of science and technology. It is the users of the facility and their activities and interactions with each other that will determine the overall impact on the advancement of scientific and technical knowledge about the Arctic regions. It would be pure vanity to suggest that without a laboratory we would remain totally ignorant about scientific and technical questions of pressing interest. The quest for knowledge will always attract interested scholars who will eventually find a way to pursue it. The presence of a dedicated Arctic Research Laboratory on the North Slope of Alaska, however, serves as a focal point for the conduct of science and engineering projects and a forum for the mutual collaboration and interaction of the users.

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XIII. Hydrocarbon-related Research in Northern Canada: The Case of the Environmental Studies Revolving Funds

Terry Fenge and Brad Wylynko

Introduction

This paper outlines the strengths and weaknesses of the Environmental Studies Revolving Funds (ESRF), a research programme that is financed by industry but administered jointly by industry and government. These funds are for hydrocarbon development on federal lands in northern Canada, offshore British Columbia, and the maritime provinces.

The Northern Context

Exploration for oil and gas in the Canadian North gathered momentum during the 1970s. In 1976 the federal government put in place its "need to know" policy to establish the volume of recoverable oil in frontier regions, including the North (Energy, Mines and Resources Canada 1976). A system of financial grants, tax incentives, and tax write-offs was put in place to encourage industry to expand its operations in Yukon and the Northwest Territories (NWT). The 1980 National Energy Program (Energy, Mines and Resources Canada 1980) and 1982 Canada Oil and Gas Act (Canada Oil and Gas Act 1982) extended the thrust of previous policy, but varied grants and incentive payments to industry with the level of Canadian ownership of companies operating in frontier regions.

Following its clear policy commitment to stimulate hydrocarbon exploration in the North, the federal government realized belatedly that it had little sound environmental and social information for making decisions about such development. Very little was then known about the impacts that new massive drilling and production technologies would have in the North, particularly in the marine environments of the Canadian Beaufort Sea, Lancaster Sound, High Arctic, and Davis Strait regions. The federal government had promised in its 1972 statement on national objectives in the North that development decisions would take the natural environment fully into account (Chretien 1972). To fulfill this promise, a number of research programmes were funded and/or undertaken by the federal government. The most innovative of these research programmes is the Environmental Studies Revolving Funds (ESRF).

The Birth of the Environmental Studies Revolving Funds

The federal government announced the ESRF as a concept to the public in 1977 in Bill C-20. The central idea of the funds was that the federal government would impose a levy on the oil and gas industry to fund environmental and social studies. The results of these studies would help government agencies to make better regulatory and planning decisions. This proposal received little discussion. The bill was soon bogged down in a heavy parliamentary agenda and was shelved by the Progressive Conservative Party when it assumed power in 1979. Some months later, the Liberal Party was returned to office and, in 1980, the federal government announced, with great fanfare, its National Energy Programme. The proposed ESRF were reinstated in the National Energy Programme and given legislative authority in the Canada Oil and Gas Act, promulgated in 1982.

The Objectives of the Environmental Studies Revolving Funds

The objective of the ESRF as set out in section 49(9) of the Canada Oil and Gas Act is:

> "Payment ... of the reasonable costs of such environmental or social studies carried on by any party, relating to the area or prescribed region subject to the relevant fund as the Minister determines are necessary in order to decide whether or not to authorize exploration or development activities under this Act or any other Act of Parliament." (Canada Oil and Gas Act 1982:C.81, S. 49(9))

Environmental study is defined in s. 50(4) of the Act as:

> Work pertaining to the measurement or statistical evaluation of the physical and biological elements of the lands, oceans, or coastal zones, including winds, waves, tides, currents, precipitation, ice cover and movement, icebergs, flora and fauna both onshore and offshore, ***human activity and habitation and any related matters***. (Emphasis added.) (*ibid.* s. 50(4))

Environmental legislation in Canada has a well-deserved reputation for being excessively general, but the ESRF are clearly defined in the Canada Oil and Gas Act. According to a senior civil servant in the Canada Oil and Gas Lands Administration (COGLA), one of the federal agencies that administer ESRF:

> "One of the fundamental reasons for developing a mechanism such as the Environmental Studies Revolving Funds was to ensure that the cost of environmental studies was equitably shared by all those active in exploration or development activities on Canada lands.... Another most important factor was that adequate (in terms of both quality and quantity) and timely regional environmental and social studies be carried out.... In addition, such a mechanism would offer the advantage of reduced chance for repetition of studies and a method of ensuring that issues were addressed in an order reflecting the needs of industry and government." (Ruel 983:30)

The Structure of the Environmental Studies Revolving Funds

The existence of two Environmental Studies Revolving Funds is due primarily to the division of authority for hydrocarbon issues in Canada between two federal agencies. One fund applies to Yukon and the Northwest Territories and is administered by officials in the Department of Indian Affairs and Northern Development (DIAND). The other fund applies to the offshore on the east and west coasts and is administered by officials in the Canada Oil and Gas Lands Administration (COGLA), an agency that reports to the ministers of Energy, Mines and Resources, and Indian Affairs and Northern Development. The administrative structure for ESRF was finalized in August 1981 in a memorandum of understanding between these two agencies and the Departments of the Environment, and Fisheries and Oceans (DIAND and Energy, Mines and Resources Canada 1981).

Two advisory boards oversee the two funds and advise the ministers on all matters relating to them. To prevent duplication of effort the same individuals sit on both advisory boards, but when northern issues are discussed a Director General from DIAND occupies the chair, and when southern issues are discussed a Director General from COGLA is chairman. Directors General from the departments of the Environment and Fisheries and Oceans are also members of the Advisory Boards, as are two representatives of the hydrocarbon industry. The latter individuals are chairmen of the Arctic Petroleum Operators Association and the Offshore Operators Division of the Canadian Petroleum Association. These representatives are expected to deal with industry-wide concerns.

The Advisory Boards play a crucial and directing role in the administration of the ESRF. They determine research needs and priorities, prepare budgets for each research area or field, oversee the two small secretariats that service both funds, and evaluate the effects of the programme. The advisory boards establish programme study committees (PSC) to oversee research in the selected fields, to call for and review research proposals, to select researchers, and to handle peer-group review of completed work. Federal and territorial governments are represented on PSCs, as is industry. To date (summer 1985), ten PSCs have been established to deal with ten subject areas: bottom sediment transport, icebergs, sea-bottom ice scour, oil-spill research and counter-measures, waves, northern terrestrial environment, marine environmental effects and monitoring, and social issues east, west, and north (Environmental Studies Revolving Funds 1985).

Funding the Environmental Studies Revolving Funds

The Canada Oil and Gas Act notes:

> "49(4) Every party who is an interest holder on the coming into force of this Act shall, at the times and in the manner determined by the Minister, deposit for payment into the relevant fund an amount based on the rate fixed by the Minister for the purposes of this subsection.
> 49(5) The rate to be fixed by the Minister under subsection (4) or (11) shall be based on the area of Canada lands subject to the relevant interests that are situated within the relevant area or prescribed region, regardless of the nature of the interest." (Statutes of Canada 1982, C. 81, S. 49(4), S. 49(5))

ESRF regulations were gazetted in 1983 and established 15 regions within which levies are applied to interest holders on Canada lands (Figure 1). The levies are based on land holdings in each region but are modified by an assessment of the applicability of each study's results to a region and by a weighting factor for each region. Regions in which no oil or gas has been discovered are awarded a weighting of 2. Regions where there is exploratory activity but no potential commercial discoveries to date are given a weighting of 5, and where potential commercial discoveries have been made, the weighting is 10. The resulting levy rate for 1983-1985 (in cents per hectare) is shown in Table 1, and the annual budget for the ten subject areas is shown in Table 2.

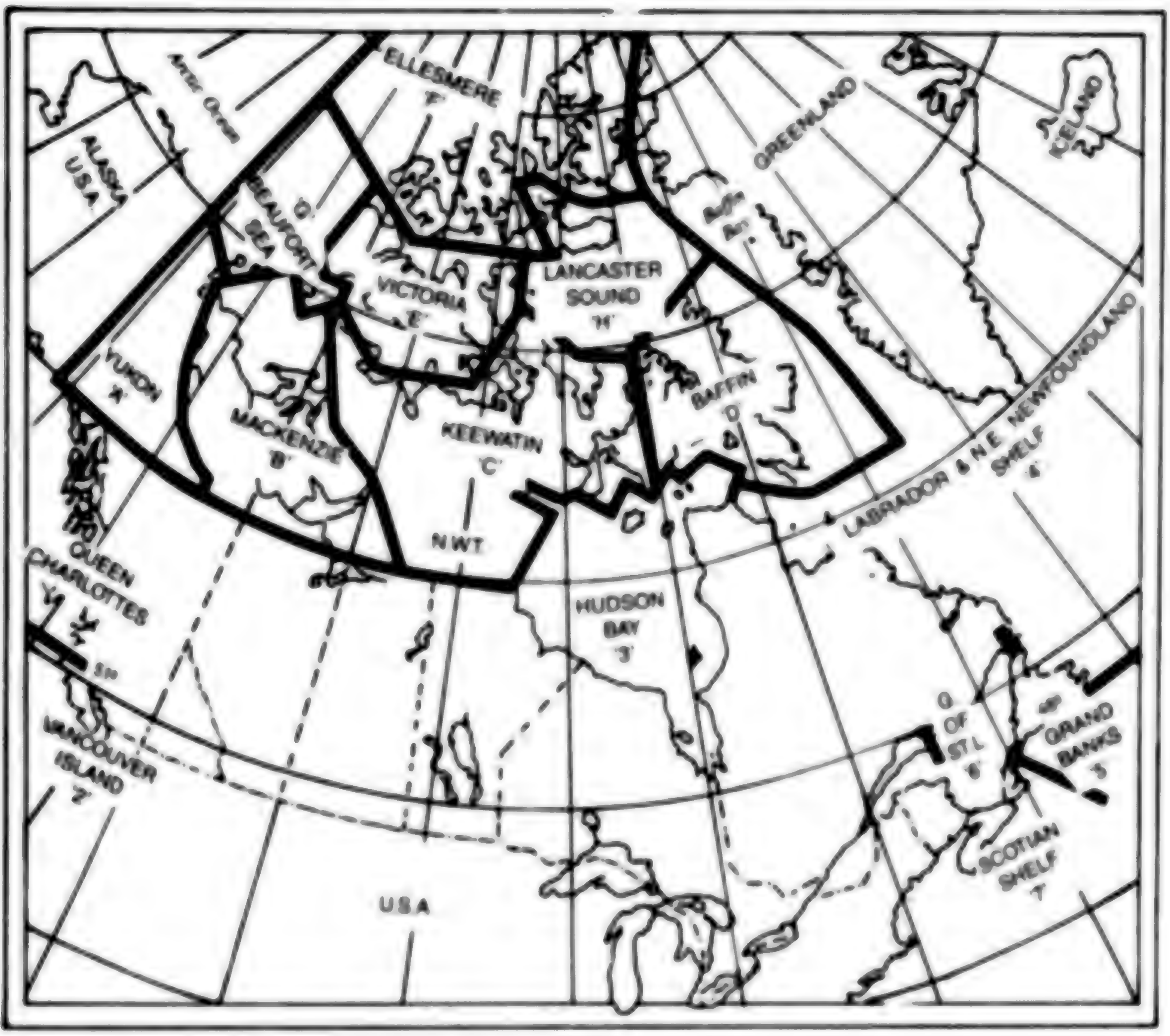

Figure 1. Environmental Studies Revolving Funds Prescribed Regions

Source: Environmental Studies Revolving Funds Regions Regulations, P.C. 1983-1505, 19 May, 1983

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Table 1. Environmental Studies Revolving Funds Levy Rates (in cents per hectare)

Prescribed Region	*1983*	*1985*	*1984*
Queen Charlottes	2.1	7.5	0
Vancouver Island	2.1	3.2	0
Hudson Bay	2.1	0	0
Labrador & NE Newfoundland Shelf	3.6	1.5	2.7
Grand Banks	10.8	30.5	23.4
Gulf of St. Lawrence	2.1	23.2	12.2
Scotian Shelf	5.2	9.5	18.9
Yukon	3.4	4.2	0
Mackenzie	3.4	2.5	0
Keewatin	3.4	0	0
Baffin	8.6	0	0.5
Victoria	3.4	7.6	2.4
Ellesmere	3.4	3.4	0.3
Beaufort Sea	5.8	27.4	5.8
Lancaster Sound	10.2	0	0

Source: Environmental Studies Revolving Funds, *1985 Budget*, (unpublished), p. 15.

Table 2. Annual Budget of the Environmental Studies Revolving Funds Subject Areas (x $1000)

Priority Subject Area	*1983*	*1984*	*Totals*
Bottom Sediments	200	370	570
Effects Monitoring	200	495	695
Icebergs	1000	1030	2030
Oil Spill Research	1300	1375	2675
Ice Scour	400	1325	1725
Social: Northern Areas	100	380	480
Social: East Coast	100	250	350
Waves	300	340	640
Social: West Coast	-	100	100
Special (ASTIS)[1]	-	375	375
Administration (30 months)	1200	-	1200
Contingency	480	604	1084
Totals	5280	6644	11924

Source: Environmental Studies Revolving Funds, *1985 Budget*, (unpublished), p. 14.

[1] Arctic Scientific and Technical Information System.

Administering the Environmental Studies Revolving Funds

According to the ESRF annual report:

> "Each year, the PSCs identify studies within their priority subject areas that should begin that year. Cost estimates for the work are made. These estimates are then combined with any variances from the previous year and from the estimated administrative costs, to form the budget request for the existing programme priorities. The Advisory Boards review the study programmes and cost estimates in light of the overall programme objectives and modify the budget according to their assessment of needs. At this level, new priority subject areas may be initiated or special studies of a general nature identified. The Boards then send their recommended budget to the ministerial level for final approval." (ESRF 1984:4)

Requests for proposals (RFP) are published in *Update*, a short pamphlet released every 3 or 4 months by the ESRF secretariats. Again, according to the ESRF annual report:

> "Once the proposals are received by the ESRF, they are evaluated as to their approach to the problem being addressed, the demonstrated knowledge and ability of the individuals and groups involved and the price. When multiple submissions on a single item are received, they are also compared to select the most promising proposal. A study agreement is then struck between the ESRF and the successful applicant. This confirms the work plan and the payment process, establishes the method of operation, and authorizes the work to commence." (*ibid.*, 7)

PSCs evaluate research proposals with the assistance of the secretariats and science advisors who may be brought in from academia, industry, consultant organizations, or government agencies. Completed research is also evaluated by the PSCs and science advisors and is subject to formal peer group review. Individuals in the U.S.A. and Europe are sometimes used in the peer group review process. If the research is deemed to be of acceptable quality, it is published by the ESRF. In May, 1985, 96 studies had been contracted under the two funds, 39 of which are directly applicable to northern Canada. To date, approximately $8 million has been spent on research under both funds. This is well below the ceiling of $15 million per annum per fund that was envisaged in the enabling legislation.

Some Key Issues

We have too little experience with the ESRF to be categorically judgemental about its successes, failures, and prospects. Nevertheless, the implementation of the ESRF raises a number of issues — some of these issues reflect its innovative and experimental nature, and others reflect well-known and continuing concerns about research and development decision-making for northern Canada.

1. Do We Still Need the Environmental Studies Revolving Funds?

When the ESRF were first proposed, it seemed the Mackenzie Valley and Beaufort Sea regions were on the verge of massive industrialization. Dome Petroleum talked rather glibly about investing tens of billions of dollars in the Beaufort Sea alone. As oil prices escalated, few questioned this vision. The mega-project mentality of the mid-to-late 1970s was largely responsible for the ESRF and other research programmes, such as the Eastern Arctic Marine Environmental Studies (EAMES), but the proposed type and scale of hydrocarbon development in the North soon changed. By 1984 the federal government was advised to adopt a policy of small-scale, phased development (Federal Environmental Assessment Review Office 1984). A more cautious approach to northern hydrocarbon exploration and development was emerging. Moreover, discouraging drilling results in deep waters in the Beaufort Sea forced some development proponents to rethink their technological plans for transporting oil and gas south to markets. Arctic class-ten ice-breaking tankers, enthusiastically endorsed by Dome Petroleum in 1980 as the best means to move oil south, were discarded only a few years later in favour of small-diameter pipelines up the Mackenzie Valley. By mid-1985 both the Canadian Petroleum Association and Arctic Petroleum Operators Association advised the federal government that the ESRF were redundant:

> "It is apparent that the original need for the ESRF has been overtaken by events. The Fund was conceived in the midseventies to address conditions existing in the frontier at that time. Since then, extensive environmental research has been carried on in the frontier areas, particularly in the offshore regions. Some work is continuing and some still needs to be carried out, but on a much reduced scale from previous projects." (Smythe and Jones 1985)

As originally conceived, the ESRF were to help policy makers and regulatory agencies to deal with regional questions relating to hydrocarbon exploration and development. Because industry has scaled down both its aspirations and its proposals, it feels that ESRF research should be similarly scaled down to deal more with site-specific and engineering issues that are of immediate relevance to their projects. Government agencies remain tied to the broad definition of "environment" found in the Canada Oil and Gas Act and to a broad interpretation of the "need" for environmental research dealing with hydrocarbon development. The federal government has yet to respond to industry's changed perception of how best to use the ESRF. It remains to be seen whether and how an applied research programme such as ESRF can survive by adapting to shifting economic circumstances.

2. Northern Involvement in the Administration of the Environmental Studies Revolving Funds

Not only has the economic context changed dramatically in northern Canada in the last few years, but so has the social and political context. Northern aboriginal organizations and the two territorial governments are now quite capable of participating in complex policy and decisionmaking processes, and are demanding admittance into the federal government's policy arena. The federal government now appears to be more receptive to such suggestions. For example, in February, 1985, the minister of Indian Affairs and Northern Development promised to devolve additional responsibilities for land and water management to the territorial governments and to involve them more in decisionmaking for mineral and hydrocarbon development (DIAND 1985:9-12).

In the past, northerners have been treated largely as subjects of research and have had little opportunity to define and pursue their own research agenda. Now they want to participate with industry and government in discussing research needs, setting research priorities, conducting the research, and analyzing and interpreting research results. In the last few years, we have witnessed a remarkable coming-of-age and growing sophistication of northern groups. No longer will they tolerate exclusion from research processes. But how best should northern groups be involved in the ESRF?

Currently the territorial governments have representation on those PSCs dealing with the northern terrestrial environment and social issues. This level of representation matches the areas of authority already delegated to them by the federal government. With the exception of an observer from the N.W.T. Science Advisory Board, northerners are excluded from the ESRF advisory board that deals with research needs, priorities, and budgets. Until they have representation on this important board, they will remain unconvinced that the ESRF serves their interests. Involving the territorial governments now on the advisory boards, increasing their representation on the PSCs, and amending the 1981 memorandum of understanding to include political involvement of territorial ministers in the ESRF would help prepare the territorial governments to assume greater responsibility for natural resource management in the future. The provincial governments in eastern Canada are now represented on the advisory board that deals with ESRF research in the South, notwithstanding the federal government's exclusive jurisdiction over the offshore. It remains to be seen whether the federal government will invite greater territorial participation in ESRF in advance of further political development and constitutional change in the North.

3. Research Coordination

The ESRF bring together a large number of individuals from various government agencies and oil and gas companies to deal with a wide range of issues related to hydrocarbon development. It is an interdisciplinary research programme that not only spans the social and physical sciences but also includes the policy sciences. With this breadth of focus come problems of coordination among and between the PSCs and the advisory boards. Implicit in the role of the PSCs is to build a consensus between government and industry on what research needs to be done, why it should be done, and how it should be carried out. This consensus-building process is political in nature but nevertheless represents what is probably the most valuable contribution of the ESRF to government thinking and decisionmaking. The lesson seems to be that the process of debate between the members of the PSCs and advisory boards is just as important to decisionmaking as dissemination of completed studies. The success or failure of ESRF depends on whether the members of each PSC can develop the required consensus. At a second level, there is growing evidence of a lack of coordination between the ESRF and other government, industry, and academic research programmes that deal with hydrocarbon development. For example, there is duplication of effort between the ESRF and the Northern Oil and Gas Action Program (NOGAP), a government-financed research programme designed to better equip federal agencies to deal with the impacts of hydrocarbon development (Indian and Northern Affairs Canada 1984).

Despite the urging of Canadian academics, the federal government has pursued an *ad hoc* approach to science and research in northern Canada, and has done little strategic thinking and planning in this area (Larkin 1978:119-127). The ESRF programme is another example of this problem. Until the federal government establishes a policy for northern science, this is likely to remain a problem.

4. Administrative Efficiency

Industry has complained repeatedly that the ESRF are cumbersome and inefficient and that "environmental research needs can be handled by a more streamlined, efficient management system, at less cost to both government and industry in time, effort and finances." (Smythe and Jones 1985). Industry and government play very different roles in northern hydrocarbon development and have different styles of management and decisionmaking. Industry has relatively narrow and clearly defined goals, and claims to use a no-nonsense approach to decisionmaking. Government, on the other hand, has to balance many, and often competing, goals and interests in its endeavour to serve the public interest. Its decisionmaking processes are routinely slow and incremental. In northern Canada, the federal government regulates the hydrocarbon industry and provides the policy and financial framework within which industry must function. In sum, industry and government have different interests, but the difference between them is least in the area of environmental research, for both parties acknowledge that good technical information about the environment serves their long-term interests. The real question, then, is what organizational structures and decisionmaking processes for ESRF are acceptable to both parties. In mid-1985, industry produced a detailed proposal to alter the administration of ESRF:

> "It is industry's opinion that the ESRF could be made much more responsive and relevant to government and industry decisionmaking, if it were the responsibility of one of the two government regulatory agencies currently sharing this mandate. The present system, with two regulatory agencies sharing responsibility, inevitably leads to inefficiency.
>
> In addition, it is our recommendation that the present Advisory Board should have a revised mandate as a Management Board, reporting to the appropriate minister. As provided for in the Atlantic Accord, we believe the government representation should be expanded to include representatives from

> provinces and territories with a significant level of petroleum activity on Canada Lands. At the same time, we believe a proportionate number of industry representatives should be maintained. The Board should meet about twice a year and set major policy directives. It should be responsible to authorize budgets and research programmes prepared by managers or specialist committees, but should not be involved in day-to-day management.
>
> For the day-to-day management, we believe that this should be handled by a dedicated industry team which we believe could respond more quickly to recommended research needs without undue bureaucratic constraint and delay. This management team would function under the direction of the Board and a small Executive Committee drawn from the Board, and would be funded by industry. This would release a number of government officials to do more productive work in their own departments." (Smyth and Jones 1985)

The advisory board is currently considering this proposal and will soon give its recommendations to the ministers.

Conclusions

CARC is now carrying out a formal programme evaluation of the ESRF. The results of this research will be published later this year. We are examining the operations of some of the PSCs to determine whether industry's criticisms of the ESRF are warranted and to suggest institutional changes to help ESRF evolve. The ESRF model for applied research has much to commend it. Opening up the process to additional interests, in particular the territorial governments and aboriginal organizations, would strengthen ESRF and perhaps secure their future in an era of continued social and economic change. The ESRF model may well be of use to other countries in the circumpolar world.

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XIV. The Land-Use and Resource Management Decisionmaking Process

Edward A. Fernald

Land-use planning and resource management involve a complex and ever-changing set of man-land-resource relationships. These processes require a concerted effort on the part of decisionmakers and scientists to achieve an agreeable plan from the values and data provided by various individuals, disciplines, and interest groups. A better working relationship between scientists, planners, and decisionmakers could make the process more efficient. Scientists often do not consider the political and economic aspects of implementing changes they feel are adequately justified by their science. On the other hand, public officials and land-use planners often have difficulty understanding the complex relationships among land uses and the resources they manage.

This paper is from the perspective of a geographer interested in land use, resource management, and decisionmaking, with experience with the Man and the Biosphere Programme and work with local and State government decisionmakers who make decisions regarding the development or protection of land resources.

The purpose of this paper is to introduce a land/resource management decisionmaking process at the operational level. At this level the public decisionmaker plays a critical role as he decides the use of man's environment in either a socially cooperative or exploitative manner. For the scientist, the paper will help identify the place of the scientific study in the larger context of land and resource management. This paper will provide a model, or frame of reference, for rational decisionmaking. The model applies to all types of land and resource projects or plans and is as applicable in the Arctic as it is in tropical Florida. A few examples will be provided which are of concern to biologists and other scientists.

It is assumed that the decisionmaking process can be understood as a sequence of rational steps describing the course of action that should be taken by planners from the individual parcel level through local and regional to the State level. The differences at each level are a matter of generalization, rather than a matter of a different type of decisionmaking process (see Figure 1). The horizontal axis of the matrix is the process steps or elements in the decisionmaking process. The vertical axis consists of the spatial levels at which the decisions take place. The following steps, or outline of elements, in the decisionmaking process will be discussed:

1. Formulating land/resource objectives at the individual level
2. Identifying land/resource needs at the institutional level
3. Gathering, storing, and analyzing land/resource data
4. Evaluating land/resource laws, policies, and regulations
5. Identifying and evaluating potential influences and tools
6. Evaluating land/resource change methodologies
7. Implementing land/resource decisions (single purpose plans through master or comprehensive plans)

These elements represent the major steps required in the land planning or resource management process. They are not sacred and may be expanded, reordered, or modified to meet specific needs although each item suggested by this outline should be considered. Within each element the practitioner implements only what is applicable and reasonable, given his constraints of scale, time, funding, personnel skills, and the level of technology available.

Element One: Formulating Land/Resource Objectives at the Individual Level

Recognition of the diverse land/resource management objectives held by society should be the first step in the development of a comprehensive land or resource-management plan. The perceptions and objectives of citizens, individuals in government agencies, and representatives of business and industry should be identified. Through this process, competition and potential conflicts for land or resources are identified. It is not surprising that various individuals may have incompatible objectives for an area such as a downstream forest. One individual may wish to see the forest replaced by an urban shopping centre; another may oppose this because urban runoff would pollute grass flats which serve as a breeding ground for sport fish; yet another may wish to keep the forested area in order to meet his own personal aesthetic needs. As we will see in the next element, government agencies as well as private institutions will have yet other alternative uses in mind.

Decisionmakers need a better understanding of the place the scientist and his scientific studies can play in the decisionmaking process. This understanding would help the decisionmaker better understand the biologist's concern for protecting a particular environment or for his statement that a potential change needs more study. It would also be a help if biologists worked with physical and social scientists to better identify the trade-offs of land-use change. It would be helpful to the planner if the scientist would develop means which would support his objectives with quantitative measures of the effects of specific land-use changes on such things as the economy, citizens' health, or aesthetics.

Problems are not solved in this initial element. Nevertheless, it is important to the decisionmaking process because it identifies conflicts, both real and potential; it provides a better understanding of data needed to make rational decisions, as well as trade-offs and compromises. It also provides an opportunity to categorize objectives into a hierarchical system of broad to specific, long-term to short-term, costly to inexpensive. In short, it gives the planner a better understanding of his alternatives and their costs.

Element Two: Institutional Land-Use/Resource Objectives

The second element in the decisionmaking process should be the identification of institutional land/resource objectives. This step is more basic than Element One. It encompasses the infrastructure needs of a community and it must take into consideration broad societal needs such as agricultural, residential, commercial, transportation, and mining uses as well as specific historical, archaeological, aesthetic, and unique ecosystem sites. To return to the example of the forested land in the downstream area mentioned in Element One, we note that there could be institutional conflicts. One government agency may wish to use that land for a power plant because of its siting characteristics while another may desire the site for a recreational area. If the forest is of commercial quality, the institutional needs of the wood-processing industry in the private sector would also have to be heard. Of course, in most cases land ownership would determine which land use would be chosen. While ownership is a necessary and practical consideration, it is not always the best determinant of land use. Institutional assessment should also identify land uses that are locationally critical such as reservoirs, airports, power sites, transportation corridors, or protected areas of unique environmental and aesthetic value.

Element Three: Gathering, Storing, and Analyzing Land/Resource Data

The third element of the decisionmaking process is complex, but it is fundamental in order to achieve, in a rational manner, the objectives and needs identified in the first two elements. It is essentially the task of telling the decisionmaker what the land or resource use is now and why. It includes a description of the physical and cultural elements in the environment and their interactions. Good scientific analysis is assumed in this element. For the scientist, this element asks questions regarding scale, and how data are to be collected, handled, and used. The answers to these questions might also impact the recording and reporting of data, explanations, and generalizations.

The problem of establishing a scale for a land-use or resource study involves deciding how much data to gather and at what level of detail. A proper solution to this problem is a function of the goals of the study, the area to be studied, the time, funding, and technology

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available, and the skills of the researchers and planning staff. Of importance to both the decisionmaker and to the scientist is the effort of each group to understand the needs of the other.

Timing is also important. It is necessary to understand the impacts of any change in the biological, physical, and social aspects of an area prior to the time a land-use decision is made. In too many cases, economic and political decisions are made prior to consultation with biologists and other scientists. Planning theory states that the first step is to identify environmentally fragile and unique resources. Unfortunately, this is not usually done. In order to do it properly, planning agencies need a staff or consulting scientist.

A problem for the scientist in this process will be learning to adapt his methodologies to studying communities and landscapes at a scale which will provide the data needed by the planner. It is not uncommon for the scientist to have to collect data at one scale and then to generalize that data to provide the decisionmaker with the information he needs. A successful project is that of Dr. Robert Livingston, a Florida State University biologist who is studying the lower reaches of the Apalachicola River in northwest Florida. Researchers have collected detailed biological data which have then been generalized and depicted on map overlays at a scale of 1 to 24,000, which is the U.S. Geological Survey 7 1/2-minute topographic sheet size. The overlay technique allows the researcher to make composites of selected data. This results not only in the identification of spatial patterns, but it also shows the relationships of physical and cultural phenomena, which need to be understood in order to develop a rational plan.

A problem some planning agencies run into in regard to data inventory, analysis, and storage is that of attempting to use sophisticated techniques, such as aerial photography interpretation or computer analysis, which are beyond their capabilities. The data analyst with inadequate monetary or technical support should not attempt to use these sophisticated techniques. Much work is being done on analysis of computerized geographic information systems and interactive graphics and their applicability to land-use and resource management. Information on the cost and practicality of such systems is needed by many local planners and managers.

Element Four: Evaluating Land/Resource Laws, Policies, and Regulations

In Elements One to Three of the decisionmaking process, the planner has gained an understanding of the objectives and needs of society and a recognition of the physical and cultural environments with which he is dealing. A set of operational goals has been established as a compromise between Elements One and Two and the reality of data inventory and analysis. In Element Four it is necessary to identify formal laws, policies, and regulations and to evaluate each in terms of their positive or negative contribution to the achievement of land use or resource management objectives. Land-use rules, for example, can be found under the general headings of police powers, eminent domain, tax policies, facilities control, and the rights-less-than-fee-simple tenure. Many laws have a great deal of influence on land-use and resource management. At the county level, the comprehensive land plan; at the State level, the various environmental land and water management acts; and at the federal level, programmes such as those developed under the Water Pollution Control Act Amendments and the Coastal Zone Management Act. Scientists and planners should examine these laws and evaluate their implications for the local area.

As stated earlier, it is desirable for the planning department to have a policy of considering environmentally fragile lands before any land-use or resource management change is considered. In practice, such a policy is often ignored because there is no one on the staff who can explain its importance. Once understood, the planner can use easements, moratoriums, preferential tax assessments, purchase of development rights, and land banking as tools to regulate development in order to maintain a high-quality environment.

Element Five: Identifying and Evaluating Potential Influences and Tools

This section of the decisionmaking process differs from the previous section, which dealt with formal landuse regulations and policies. This section suggests that the planner be aware of new and informal tools which may have an impact on his efforts to achieve his stated goals. This would include identifying tools which have been successfully used by others.

Element Six: Evaluating Land/Resource Change Methodologies

Land-use and resource changes are inevitable. In all changes there are trade-offs. It is important that the planner understands these tradeoffs in order to allow him to make his decisions based on facts and rational thinking. Change methodologies need to be developed and evaluated to serve as guides for the individual who is thinking about optimizing a short-term profit on a small parcel of land, as well as for the regional decisionmaker, who wishes to develop a series of institutional changes with a river basin-wide impact. Geographers use economic models to explain land-use patterns, but much work is needed before the planner will have a practical tool to help him make decisions.

Ecologists have developed many different types of carrying capacity models, but generally these have not been very helpful when trying to measure the carrying capacity of an area for man and his activities. We need to devote more time to comprehensive studies of wetlands and river basins and other environmentally fragile areas that are threatened by "development." Ecologists not only need to analyze the biological character of an area, as it is covered in Element Three of this paper, but they also need to attempt to set forth implications of any proposed changes. This latter concern is the purpose of the sixth element.

In guiding land-use or resource change it is important to adopt a very conservative policy. That is, unless the change is understood fully and agreed on by nearly all those affected by it, the change should not be implemented. At any later date, a forest can be cut, a dune can be destroyed, a marsh can be filled, or a mineral can be mined. In nearly every case, after an elapse of several years, the marsh, the forest, the dune, or the mineral will be worth more than at the time the modification was rejected. The important fact which a decisionmaker must understand is that once a marsh or a sand dune or a forest has been modified, it is very difficult, if not impossible, to recreate the natural landscape. In every case it is the long-term profit, not only in terms of money, but in terms of environmental and social amenities, that should be considered before change is permitted. The applicability of this generalization increases as one moves from the land parcel to the regional level. The primary importance of developing land-use or resource management models is that negative effects of irreversible changes may be identified when the changes are on the map and not on the landscape.

Element Seven: Implementing Land/Resource Decisions (Single Purpose Plans through Master or Comprehensive Plans)

Implementing land-use or resource management decisions, whether in the single purpose project or in an overall comprehensive (or master) plan, is the final element in the decisionmaking process. It should not, however, be a stopping point in the process. A master plan for a large region and its associated maps would be the output documents that present and explain the best societal use of the land or the resource at a specific time. Master plans should not be considered blueprints for environmental protection or for development. They should suggest the optimum use or protection of the resource and identify development limits based on the support capabilities of the physical systems.

A valid master plan is no more than a statement of the best thinking of the moment in terms of the citizens' attitudes and available fiscal, natural, and technological resources. The master plan should be used not only for analysis, information, and education, and decisionmaking at the time it is implemented, but also for input into a recycling of the planning process.

There are several problems with the master plan approach that may be avoided if recognized in time. In certain circumstances plans are developed that have completion dates that do not allow time for modification. A weakness of some other plans is that they are too complicated for people to implement. In other cases they require a much higher level of funding than the local area can afford. Still another problem of the master plan approach is the possibility of creating a situation whereby the planning agency is without the power to execute the plan. In this case the development of a planning programme is an exercise in futility. Finally, the master plan should be flexible enough to allow for self-correction. If it does not, it becomes a self-fulfilling prophecy.

The development and output of a land-use plan is not a linear process: any change in availability of money, in cultural or physical resources (including technology), or in the objectives of the populace should be considered new information and folded in accordingly. This kind of dynamic plan will allow for modification based on the careful analysis of legitimate input. This point, however, does not invite the modification of a master plan in the same sense as issuing a variance to a zoning ordinance. All changes should occur because of the recycling of the entire model rather than as a result of unique pressure applied by individuals out of the planning context.

In summary, it is vital that planners, scientists, and citizens think through the elements of the land/resource management decisionmaking process. This model applies to urban or rural land-use or resource management. To use this process, however, the planner needs to understand and appreciate the value of the scientific data, while the scientist needs to cooperate in the development of a better means of communicating with decisionmakers.

Land Use/Resource Management Decision Making Process

PROCESS STEP / SPATIAL SCALE	INDIVIDUAL OBJECTIVES	INSTITUTIONAL OBJECTIVES	DATA: COLLECTION AND ANALYSIS	LAWS, POLICIES, AND REGULATIONS (FORMAL)	TRENDS, TOOLS, AND INFLUENCES (INFORMAL)	RESOURCE CHANGE MODELS	IMPLEMENTATION
Large Scale Project 1:1 1:1,200							
Neighborhood 1:1,200							
City 1:1,200 1:15,000							
County 1:24,000							
State 1:250,000 1:1,000,000							
Region RPC/WMD 1:24,000 1:100,000 1:250,000							

Note: Each cell serves as a series of questions and as a depository to organize data and project needs. Data is to be evaluated and projects are to be placed in a hierarchy in terms of importance, cost, time, and technical resources available.

Figure 1. Land Use/Resource Management Decision Making Process

Figure 1. Land Use/Resource Management Decisionmaking Process

XV. Serving the People of the North: From Advocacy to Participation

Timothy W. Kennedy

When analyzing the process that takes place when someone attempts to assist a community to increase its participation in the decisionmaking process of government, the tendency is to study the comparative effectiveness of the strategies and tools that were used to this end. By carefully examining the effects of the strategies and tools, the reader should be able to make a more informed decision as to which of these could best be used to accomplish his purposes. However, the reader should realize that although much can be learned from studying the strategies and tools, what ultimately has the most meaning is the person who implements the strategies and tools and the relationship he builds with the community or group being assisted.

With this in mind, the purpose of this paper is to define and examine a typology of three roles used by field workers, with an emphasis on the comparative effects of the roles on those being assisted.

Social Broker

The field worker as social broker serves as a "go between," controlling the information flow between communities and government decisionmakers. There is a minimum amount of involvement and identification with either party. By brokering the information flow, he effectively prevents any direct interaction between the communities and government decisionmakers, thus making both parties completely dependent on him. The broker does not raise expectations that change will occur.

The broker role creates a double-edged self-fulfilling prophecy with dependence. Both the community members and the government official tend to live up, or down, to the expectations of the broker. The community members become increasingly dependent on the broker for information and advice, thus confirming the broker's preconceived belief that they are not capable of acting on their own behalf. The government officials become increasingly irritated by their dependence on the broker because he prevents any direct communication with their constituents. This irritation, manifested by a non-cooperative stance, again convinces the broker that he is needed more than ever. The community members are then led to believe that government officials do not want to respond, and they feel that much more powerless, frustrated, and confused. In their desperation, they are more willing than ever to be brokered. This entropic process of dependency can last for an extended period of time because the community members and the government officials have little or no opportunity for direct, unencumbered interaction. The process is the social equivalent of what happens when you buy or sell a house through a real estate broker. Whether you are the buyer or the seller, you are constantly dependent on the broker to inform you of the other party's intent. No direct conversation of any substance ever takes place between the prospective buyers and the seller, and even when both parties get together with the broker at the closing, very little conversation takes place, even if the process occurred over a long period of time. Neither party has been able to circumvent the broker long enough to build any relationship independent of the broker.

Because there is no hope that change can occur, people being brokered tend to feel "absolutely weak." In this situation, they vent their anger towards each other. They "implode" rather than strike out against the broker who represents "absolute power." To illustrate, when the Alaskan villagers where I lived became angry with the BIA Principal Teacher or the missionary, they started binge drinking and ended up fighting each other before the night ended. They saw their own weakness reflected in each other and directed their anger at their only safe opponent — themselves.

Social Advocate

The field worker as an advocate acts on behalf of the community he represents. His emphasis is on changing the attitudes of government decisionmakers in the hope that if they are properly enlightened or coerced, they will be more responsive. He does not assist the community members to acquire the knowledge and confidence to eventually act on their own behalf. Advocates are usually "issue or programme oriented" and do not think in terms of an on-going process of community organization. The resolution of an issue or the initiation of a programme are ends in themselves.

Advocates I have observed seemed to feel that community problems could be solved if a concerned outsider who knew the system could intercede on their behalf. They believed that if citizens tried to approach government officials directly, they would be frustrated in their efforts every time. They wanted to assist the communities, but on their terms, using their methods, their time frame, and in many cases, their issues. In the cross-cultural situation of rural Alaska, many of the advocates I encountered also expressed a deep and abiding sense of guilt about the way Native Alaskans had been treated by the "white man." They wanted to show Native Alaskans that some whites were not bad. Being an advocate for the Native Alaskans was a concrete way to absolve their guilt feelings. In effect, they were meeting their own needs while intending to assist Native Alaskans.

The advocate role creates a self-fulfilling prophecy with an insidious dependency. As the community members become increasingly aware that the advocate knows a lot more about the government decisionmaking process than they do, they tend to become more willing to let the advocate represent them and accelerate their requests for assistance. This proves to the advocate that he is not only needed but is acting in the best interests of the community members. The government officials fulfill the prophecy no matter how they respond. If they respond positively, the advocate believes he is responsible for an attitude change; if they do not respond, or respond negatively, he is convinced of the need for more advocacy.

Unlike the broker, the advocate promises positive change, thus raising the expectations of the community members. In the short run, because the focus is on changing the attitudes of external forces, the community will not blame the advocate if positive change does not happen. But in the long run, if the community's hopes are raised and dashed too many times, they will vent their anger outwardly. They will *explode*. And they will direct their anger at the advocates who raised their expectations. And because this explosion will be done in anger and frustration, the actions will be self-destructive and will indict community members as irresponsible and irrational citizens.

Social Animator

Unlike the advocate, whose emphasis is on changing the attitudes of government decisionmakers, the animator's primary concern is to create an attitude change within the community. He believes that the community will eventually develop a sense of collective power that, when exercised in a responsible manner, will provoke a *response* from government officials, whether they change their attitudes towards the community or not. The animator role also encourages a double-edged self-fulfilling prophecy, but without dependency. The community members, by acting out the process of identifying their own needs, arriving at a consensus for action, and then taking their own direct action live up to the expectations of the animator, who firmly believes that the community members are capable of planning and implementing their own social change process.

The government officials live up to the expectations of the animator by responding to the direct pressure created by a well-organized constituency. If they respond positively, the community knows that its collective action precipitated the response. This experience serves to build the confidence of community members, thus making it easier to take further action if it is needed. The government officials also benefit, because they can take credit for responding to the needs of their constituency. If there is a negative government response, the community members have a process by which they can re-examine their actions, initiate alternative strategies, and then take further action. In this instance, the government official is held accountable for the negative response and will have to confront the consequences of his position when the community members take further action.

Whatever the government response, the most important aspect of this process is that the animator focuses on the competencies of the community members who become the subjects of their own social change process. The process of social animation does not focus on the expertise of an outside third party who is somehow going to compensate for what is lacking in the community or group he is assisting. The animator provides information, strategies, and tools to enhance and strengthen organizational process that is controlled by the community he is assisting. The social animation process is built on the expectation that the community will eventually be able and willing to act on its own behalf, independent of the animator. The experience gained through direct interaction with government officials gives people the confidence to act completely on their own.

The animator also raises the expectations and hopes of the community or group he is assisting, but as a result of their active involvement in each step of the process that takes place with government officials, they are more aware of the realities of the situation. Their involvement makes them less vulnerable to simplistic interpretations of what can be expected from government officials and serves to keep their hopes and expectations in perspective.

While the animator role is the most demanding of the three, I believe it is the most empathetic and effective role for the "outsider" to choose if his objective is increasing citizen participation in the governmental decisionmaking processes.

Personal Factors

Just being empathetic, though, is not enough for the animator. There are other personal factors which, if anticipated, can strengthen and enhance every aspect of his relationship with the community. They are: (1) the animator's initial attitude towards the community members and how it is expressed; (2) the animator's attitude towards success and failure, and (3) the animator's attitude towards reward and gratification.

When the animator first becomes involved with a community or group, he must have a ***genuine respect for its members***. This concept sounds so simple that the animator can be tempted to automatically assume that he has it, to consider the matter no further, and to get on with the more difficult business of strategy development. However, I have seen too many well-meaning field workers fail because they did not manifest this attitude. The proof, after all, is in the manifestation, not merely informing people that you respect them, or in just believing it yourself. Since no other shortcoming will be perceived as readily by community members, particularly in a cross-cultural setting, or interfere so adversely with the relationship between the "outsider" and the community, a thorough examination of respect and how it is expressed should be the first step for social animators.

Respect can be defined as a feeling of deferential regard for another, a willingness to show consideration or appreciation. For the social animator, this means believing at a very basic "gut" level that the people to be assisted are equals — that although their culture and lifestyle may be different, they are not inferior or "culturally deprived" because of these differences. It means valuing people for what they are when you first meet them, not for what you think they will become once they have been assisted by you. And most of all, it means recognizing that the people you will be working with already possess a set of talents and potentialities. While you may be successful in helping to develop and mobilize these capacities, you cannot give to another what is already his.

The animator conveys respect by being vulnerable to the community or group, in the sense that he lives and works with them on their terms. By doing this, the animator has to learn from the people as well as assist them. A relationship develops, based on mutual respect that eventually leads to a horizontal exchange of ideas, opinions, and skills. An all-important dialogue begins and is nurtured by the ordinary interactions of day-to-day living, not through dramatic, formal gestures. This willingness to learn from the people you are assisting will be greatly respected, and they will tolerate the inevitable mistakes everyone makes while adjusting to a new situation. If anything, making some mistakes while learning has a humanizing effect that can also be an ice-breaker and source of fun.

I have made many mistakes over the past 18 years, but the one that best illustrates these points occurred when I decided to speak Inupiaq for the first time in public. I had been learning as much as I could about the language for 5 months before I attempted my public debut. It was Election Day and one of the Inupiaq candidates for the State Legislature was in the village. He was talking to a group of elderly women when I walked by. I knew the candidate and decided to impress him with my ability to speak Inupiaq. I also wanted to show the elderly Inupiaq women how well I was progressing, since some of them had been my teachers.

I thought I would just stroll by and casually say *ang ilaaq niag tunga* ("I'm going home") as I passed the group. I knew the phrase well, and it seemed to fit. I waited for just the right moment, said my phrase, and all of a sudden, the women started screaming *achakong, achakong* ("I'm scared, I'm scared"). During the commotion, my candidate friend put his arm around me and proceeded to tell me what I had just done. Instead of saying *ang ilaaq niag tunga* ("I'm going home"), I had said *ang uyan niaq tunga* ("I'm going to punch somebody"). I went over to the women and told them what I had been trying to say. They roared with laughter and began giving me examples of other Inupiaq words and phrases that sounded similar, but had totally different meanings. From this experience, I learned quite a bit about the subtleties of the language; the elderly women discovered that I was serious about learning their language; and we all had a good laugh in the process.

These experiences convinced me that the animator must treat the community *as a whole* by becoming involved in all aspects of community life. Some animators make the mistake of just dwelling on the negative aspects of community life. They feel that since they are in the community to assist people to solve their problems, they must focus all their time and energy on uncovering difficulties. This is a serious mistake. Every community, no matter how beleaguered it may appear to the outsider, does not think of itself only in negative terms. By focussing exclusively on the negative, the animator is asking this community to deal with its problems out of context — an experience which quickly becomes oppressive. The animator becomes an equivalent to the social worker who only deals with the alcoholic aspect of a client's life, denying the person as a whole. Under these circumstances, there is no way to have a horizontal exchange — a dialogue — between the social worker and the client. Instead, the client is encouraged to continually dwell on the deviant aspect of himself, in order to maintain the relationship with the social worker, since the social worker (who is in control) has not indicated any other interest. The client is actually being rewarded for perceiving himself as less than whole. He is denied the very context every person needs to understand those aspects of his behavior that cause problems — the necessary first step in seeking a solution. If the client finds the relationship oppressive, the only options are to capitulate or to stop going to the social worker. The latter choice will usually result in a recalcitrant or uncooperative label for the client.

When the animator encourages a community to focus on its problems, the same entropic process occurs. The community members are likewise rewarded for dwelling on the negative aspects of their lives. As the process becomes oppressive, the community members are faced with the choice of continuing it or doing nothing. Often, the community members who stop responding are labeled "fatalistic," "apathetic," "superstitious," "lazy," "stupid," or "resistant to change." In effect, the animator who wants to assist communities to solve their problems by encouraging them to dwell on them is meeting his own needs, not those of the community. This is a patronizing and counter-productive interpretation of the animator role.

Another important personal factor that affects the animator is the *success-failure* mentality. I discovered that when I thought in these terms, I attached too much importance to my actions and their consequences. As I gained experience, though, I found myself thinking more in terms of "what worked" and "what didn't work." This essentially different attitude was less emotionally charged and less egocentric. I was able to act without the vertical, "all or nothing" "success-failure" pressures, and without an achievement-oriented index. This was an important break-through for me as an animator, because my feelings were being transferred to the people in the community. If an animator thinks in success-failure terms, the people in the community will think in these terms. Success or failure implies absolute terms. An action either succeeds or it fails. There is no middle ground. On the other hand, if the animator thinks in the more pragmatic, horizontal terms of "what works" and "what doesn't work," a more constructive attitude is conveyed to the community. When a particular course of action doesn't work, the community will be able to discuss the reasons why, and then choose from a number of other horizontally-weighted courses of action. The people in the community eventually learn to anticipate that a particular course of action may not achieve the desired results, so they examine a number of alternatives before taking their initial action. They are not burdened by the pressures of an all or nothing strategy, so they do not have to make vertically-weighted "either-or" decisions.

As the people in the community begin to apply what they have learned from the animator, they will experience their first sense of accomplishment. At this point, the animator must confront his concept of *reward and gratification*. Everyone wants to be appreciated and rewarded for his actions; a person acting as an animator is no exception. The animator's reward cannot be direct and personal because his expertise is not the subject or the focus of any phase of the social-change process taking place. The animator's reward does not come from direct expressions of appreciation from the people he is assisting. It comes vicariously through the accomplishments of the community, for when the animator has done his job properly, the community will not attribute its accomplishments to him.

I first experienced this in the Alaskan Arctic village of Noorvik. The parents of children enrolled in the local BIA school had started the first Parent-Teacher Organization (PTO) in the history of the village. The parents were proud of what they had accomplished, and the teachers were visibly impressed by the parents' interest and concern for their children. It was an exciting experience for me as well, knowing that I had animated the events leading up to the formation of the PTO. However, after the first meeting of the PTO, not one parent thanked me for what I had done, and that, I eventually realized, was the best reward I could have received for my efforts as an animator.

No matter how dedicated the animator may be to this working ideal, he may never be able to completely overcome the desire to receive direct thanks for his efforts. Yet, to be effective, he must learn to subjugate the desire to satisfy his personal needs. This can be sorely tested when the community members become cocky after experiencing their first accomplishments. Intoxicated with their newly found sense of power, they may even taunt the animator for not being there when they needed him. This is a traumatic experience the first time it happens, not only because of the emotional conflict it creates, but also because it means the animator must begin to phase himself out of the community. There is no formula for determining when this should be done. It is a gradual, intuitive process that takes into consideration signs of the community's increasing independence. The "art" of being an animator is never more apparent than at this stage of the relationship with the community.

When the time comes to actually leave the community, it will be a painful experience for everyone. Relationships that grow out of empathy are special, and the personal loss will be great. Yet, the animator can be satisfied in the knowledge that because he has done his job well, he is redundant.

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XVI. Anthropological Models for Science in the North: Doing and Delivering Science Cross-Culturally

Ellen Bielawski

Introduction

Anthropology may well be thought of as much for misunderstandings it has perpetrated as for knowledge it has yielded. It has always, however, had a laudable and useful goal: the understanding, through recording and interpretation, of the indigenous cultures of the world. In recent decades the discipline has also turned its attention and cultural approach to problems within Western culture.

It is my first premise that science in the North, including anthropology and other social sciences, should serve northerners. It is my second premise that anthropology has more to offer the development of policy and conduct of research in the North than it has ever had in the past. This contribution may occur through the application of the anthropological concepts of "emic" and "etic" perceptions to the definition of research problems, the research process, the conclusions reached and their communication to crosscultural audiences.

Simply put, emic categories of knowledge are those defined within the reality of "other," usually meaning native cultures, while etic categories are meaningful to the researcher in terms of the researching culture's scientific theory. The application of emic perception to all stages of the research process implies that this process will be meaningful and understandable to the native culture. This applies whether the research is about culture *per se*, as it is in anthropology, or about any part of the natural world in which a culture exists.

Acceptance of the separate reality defined by another culture is critical where research is conducted cross-culturally, especially where the relationship between cultures is one between dominant and subordinate groups. This has existed in the North since Europeans first entered the New World; the archaeological record indicates that it existed between prehistoric, indigenous inhabitants as well. Northwest Territories society today comprises different interest groups and different cultures engaged in dominant-subordinate cross-cultural interaction. Scientific research is conducted within this social and political context.

Recognition of an emic perspective need not be a matter of suspending one's own well-documented and logical reality (and thus the well-founded principles of Western scientific research). Rather, it is accepting that another reality exists in the minds and society of other individuals; of recognizing and giving credence to that belief system. Application to the research process follows in an enhanced skill for conducting science in the social context of another culture, thus increasing the likelihood of valid and successfully achieved results; for building on existing human knowledge, which may come from the indigenous culture; and for applying the results successfully in the contemporary North.

A Case Study in Doing and Delivering Science Cross-Culturally in the Northwest Territories

This anthropological approach to doing and delivering science has grown through experience as a participant-observer in Northern science. My observations are based on work with students (Inuit, Dene, Metis and Caucasian), academic peers, non-resident Northern workers in several spheres, various government agencies, and more than twenty primarily native communities over a 10year period. Much experience has come through initiating and operating the Northern Heritage Society's applied science project in the eastern Arctic; additional community contact was gained through employment with the NWT museum programme. The Northern Heritage Society (based in Yellowknife) serves as a case study to illustrate some problems and possible solutions in doing and delivering science in the North.

The major objective of the Northern Heritage Society (NHS) is to preserve and promote cultural and natural heritage through research, education and training. It strives for the mutual education of the people of the north and for scientists, educators and other interest groups, to the advangage of all parties (Cole and Bielawski 1981). Begun 7 years ago by people deeply committed to involving northerners in research, to education and training, as well as to conducting research of the highest quality, it is today maintained by a growing staff and alumni participants. It works towards two general goals: heritage resource conservation, and human resource development.

The programme began as an archaeological field school. It has since expanded to include ecology and earth science components as well. Students (originally 8 per season, now between 10 and 12) attend a brief technical orientation each morning, work all day as field assistants, and attend classes or laboratory sessions four nights per week. Students are responsible for field notes, readings, laboratory projects, and keeping a daily journal. The staff, including an archaeologist and two archaeology supervisors, one biologist, a geographer and a cook/coordinator, is responsible for research, monitoring data collection, teaching on-site and in the classroom, and informal counselling and teaching. Scientists and other technical and professional people working in proximity to the field programme are recruited, before and during the field season, to give guest lectures and fieldwork instruction to the students. This is a two-way learning experience, for many professionals have never previously worked with northerners.

The curriculum covers standard field and laboratory methods, Arctic prehistory, history, ecology, and physical geography. The field and classroom aspects serve ideally to demonstrate the integration of environmental and cultural developments. Modern northern society is discussed in the context of past and present human adaptations to environment, to other cultural groups, and to change. Most importantly, the students participate directly in research and work closely with scientists as role models.

There is a strong hidden curriculum, based on the premise that a secure sense of one's heritage gives each individual a stronger, more adaptively successful sense of self in today's world (see Cole 1981; also Freeman 1981). Furthermore, students are encouraged to understand science and its role in the changing North, as they will be the people eventually responsible for evaluating, and living with, the results of research and development. They are the future decisionmakers of the Arctic. I quote from the NHS 1984 report: "The NHS graduate ought to have confidence in stating that 'science works for everyone'." (Bertulli and Strahlendorf 1984:32).

Fifty-five students have participated in the programme. Most are Inuit, and have come primarily from small Arctic communities. Metis, Dene, and Caucasian participants have also come to the programme, from communities well within the treeline. Applicants must be NWT residents, between 17 and 22 years of age. There is no requirement of current enrollment in school or adult education, but reading and writing English, and basic math skills are required. Upgrading in these basic skills is a process occurring throughout the programme. The academic level of the student is rising each year. This is beneficial to the programme, which can now incorporate more of the subtle concepts of science into the curriculum. Students are recruited through a comprehensive process including contacts in regional schools, all communities, adult educators, previous project supporters, and general publicity via Anik Info satellite and other media. The programme is now receiving nearly 60 applications for 12 spaces annually.

The project operated from 1979 to 1983 on Somerset Island, and is now established on Devon Island, thus dispelling any myth that it might be impossible to conduct field schools, or work with native northerners in isolated and rigorous locations. Research conducted to date includes archaeological excavation of a large, complex Pre-Dorset and Dorset Culture site, with survey and excavation at smaller satellite sites, on central Somerset Island. Several projects are now in progress on Devon Island. The archaeologists are excavating a Pre-Dorset and Thule Culture site. The biologists have begun an Arctic haze pollution study with two components. One is water-quality sampling of seven lakes in conjunction with the federal Department of Environment, Inland Waters Directorate. The second is a study of pollutants carried in *Lepidurus arcticus*, a freshwater crustacean. Population studies and parasitology of Arctic char are being examined, and the students also participate in descriptive botany, an on-going bird census, and a musk-oxen behavioural study. In 1985 students aided a study of Inuit folk ornithology. Earth science studies include vegetation cover, soil types, and effects of slope, aspect and moisture at an intensive study site, and examination of macro and micro processes of terrain formation at selected locations away from the base camp. One long-term study will be the environmental impact of a scientific field camp used for several years on a unique Arctic location. Meteorology is also taught through daily weather observations, which are broadcast to Resolute Bay and incorporated in a long-term study by the Polar Continental Shelf Project.

The NHS has reported much of this research, as well as results of its educational programme, in six Annual Reports, in technical papers, and in articles for the general public (see Bertulli and Strahlendorf 1984, Appendix J). Copies of reports go to all participants and concerned communities. Numerous community consultations have been conducted since the project's inception, and on-site visits are also part of the programme where feasible. Through the recruitment process, the return of participants to home communities, and the aid of local contacts in getting students to and from the field site, many people have become aware of and involved in the annual field operation. Students attending the regional high school in Yellowknife have also participated in the cataloguing of collections for analysis, and received work-experience credit.

Unfortunately, financial constraints have limited the pace at which the programme has developed and the distribution of research results, as the highest priority has been given to continuing the field programme, with its direct delivery to students and indirect benefit for their communities. Only in the last 2 years has the NHS been able to hire one full-time Executive Director, and devote money and time to development. Broadly based financial support for the NHS has been slowly garnered piece by piece from private foundations, the private sector, federal job creation and training programmes, federal agencies such as the Polar Continental Shelf Project, without whose logistic support the field costs would not be borne, and various departments of the NWT government. The lack of long-term, dependable support still makes implementing projects problematic.

The NHS seeks the highest quality in research, education and training, and a balanced integration of all three. It seeks also to use the knowledge both of northerners and scientists, and to further the preservation of natural and cultural heritage, to advance science *and* northern interests, through integration and communication of cross-culturally generated knowledge.

Social Context: The Project Impetus

What forces have shaped the initiation and development of this project? Why are these, and the project as one response, significant to the process of developing Arctic policy? What are the concerns of the scientific community, and how are these affected by what is happening in the North? What are the concerns of northern residents?

Scientific institutions, governments, and native groups have all stressed the need for local, especially native, involvement in research (Science Council of Canada 1977; Social Science and Humanities Research Council of Canada 1981; Department of Indian Affairs 1981; Swinton 1976; Weetaluktuk 1979; Inuit Cultural Institute 1981). Recommendations to scientists and requests from northerners have most often included returning research results to communities in an accessible form; local and regional consultation throughout research projects; and training, education and employment for northerners ("not as laboure [illegible]" Weetaluktuk 1979) on scientfic projects.

Scientists, if bearing in mind these requests and recommendations, give pric [illegible] a different set of concerns: research freedom, continued access to data, and conservatic [illegible] management of data.

Communication between scientists and northerners is minimal not only because these groups speak different literal and figurative languages, but because of mutual isolation. Scientists have had no year-round base for scientific activities in the North, and most are still attached to southern institutions. Through their activities, they participate in the social fabric of the North, and affect it through the results of their work, yet they remain isolated from these effects. This isolation has sustained thinking on the part of outside academics that the North remains a research preserve where science can go forth without consideration of northern resident interests.

One long-awaited development may ease this isolation. After several years of discussion and negotiation, the Science Institute of the Northwest Territories is a reality. The Institute should become a coordinating agency for research in the North, and integrate the agendas of academic research and northerners.

Scientists face another problem while working in the contemporary North. This lies within our academic environment, where there is little if any reinforcement for fulfilling the requests of northerners about science. The measures of academic work are those which serve the professional and university student: publication of technical papers, administrative duties, university teaching, and service to professional associations. Addressing research results to northerners may be perceived as impossible simply through lack of time.

A deeper problem, however, will be more difficult to overcome. We scientists are relatively ignorant of the skills necessary to cross-cultural communication, particularly when transmitting technical information. Communication moves to and from northern residents, and comprehending what northerners are saying is also part of the learning process. It is important to consider if and how the volatile social context of the North may affect the practice of science, and perhaps even the theoretical foundations of some disciplines. What means exist, then, for conducting northern science which embodies the quest for knowledge, but also responds to human needs?

Roles for Researchers

1. ***Role models***. Field assistant positions for northern residents place them in direct contact with professional scientists. Simply by working in proximity to individuals, the scientist becomes accessible and serves as a role model. The prospect of seasonal employment with field parties, coupled with work which takes place in a context familiar to many northerners — that is, on the land — are strong incentives for people to learn on the job. Other cultural needs are also met through seasonal employment, which allows partial dependence on a subsistence lifestyle at other times of the year. Thus scientists are in an ideal position to contribute to education and training for northerners. Commitment to training which makes the job meaningful is essential to the success both of the data collection and of the employment experience.

2. ***Graduate school education in research context***. Northern scientists in training are rarely exposed to the complex influences on northern science, nor are they encouraged to become aware of these. The relationship between science and northerners could be introduced into graduate programmes in a variety of ways. Seminars, reading courses, or special projects could cover the following topics: land use and research permit systems, legislation, community contact, information return, management of data bases, access to data, and cross-cultural perceptions of science. Seminars could include students of one discipline considering these topics for the North and for comparable areas internationally. Alternatively, students of several disciplines specializing in northern research could examine the same topics. Researchers and science could benefit through this approach because the conduct of science would be facilitated, and in cases perhaps applications would benefit; northerners would benefit through science conducted sensitively and also through applications.

3. ***Participation in policy development is required***. This may be approached both through individual activities, possibly project-specific, and through professional associations. These may work with government and native organizations through committees of the associations. It is also appropriate, and perhaps important, to include discussions of social context and the implications of policy and political development for research. Scientific colleagues may also work to heighten the awareness of their peers about the effects of the researcher's presence in the North, and of his or her research. Information on funding sources for writing, translation, and distribution of non-technical research summaries, and for training funds, can also be disseminated through professional associations.

4. ***Production and distribution of research findings to the North is required***. This may be achieved through non-technical, brief, graphic, and translated material. Photographic displays with brief captions, preferably translated, are effective in community offices, adult education centres, and schools. Summary reports to community councils are important, but the readership is small. Reading is often difficult for many northerners who speak English as a second language, thus photographs seem to reach more people. Radio and television

interviews are also good, and are easily accommodated by the scientist while intransit through larger northern communities. Curriculum units developed by researchers and educators together are a positive, indirect approach to regions where long-term research is conducted. Means for distribution to the public exist but may still take effort for the researcher to locate them. Skilled translators may be difficult to locate, but can be found if the researcher works with the communities proximal to the field work. The scientist's responsibility is to ensure that funds and time are budgeted for these efforts, which will prove to be a relatively small part of the overall research endeavour.

Changes and Prospects

Much progress has been made since one of my early community experiences, where the Council stated clearly: "archaeologists have worked here for a long time, they never tell us what they are doing, and we don't want you here." What is now known as the Northern Heritage Society accepted the challenge presented directly by that community, and indirectly by many northerners: to bring them into the research process. It is satisfying to note that nine of the programme's graduates have come from that community, and several have gone on to employment with other field parties. Another significant step has been the advancement of one graduate, very successfully, into a teaching position with the field staff. Other, similar programmes have been conducted by other agencies in the Northwest Territories, in Yukon and Alaska (for example, see Gerlach *et al* 1985).

One of the long-term benefits now emerging is the employment of graduates on other scientific field parties. This is particularly satisfying when this represents initiative on the part of the scientist, rather than a response to local hire or training-funding policies. One of the greatest benefits is the demonstration, to scientists and graduate students, of the abilities, skills and keen interest northerners have in science.

To further this development, the NHS is implementing the Arctic Science Assistant Programme (ASAP — an apt acronym for a much-needed project). For some years the NHS has functioned informally as a placement agency connecting skilled northerners with scientists. ASAP now intends to establish comprehensive, annually updated files of northerners, their level of training and education, and scientists seeking their skills. ASAP will handle placement directly. Unfortunately, ASAP has only been funded for 8 months; to maintain this programme will require additional funding.

Theoretical Implications for Science

Western philosophies of science and Inuit beliefs about the natural world differ in approach to problem solution (Wootten 1983). The goal for western scientists is to question knowledge, to discover *why*. In contrast, it appears more important to Inuit to have confidence in knowledge — the why of phenomena matters less. These approaches, however, may mutually benefit, rather than exclude each other. Science education research in the eastern Arctic led Wootten (1983) to describe this fundamental difference in perception.

The general sense of Wootten's conclusion, and those reached by Miller (1980) in an analysis of archaeology in other cultures, evidence the concept of emic and etic perceptions recognized in anthropological views of non-western cultures. Miller's description of archaeology holds true for western science in general: "there is nothing in most traditional societies that in any way parallels it ... its methodology, paradigms and context are all unprecedented ..." (1980:10). In order for science to be conducted well in the North today, and to serve it, science must shift not methodology, nor paradigms (initially) but context.

What are the implications of such a shift? One may be more applicable research results. Another may be the growth of knowledge through incorporation of native observation and interpretation in research conclusions. In at least one instance during the Northern Heritage Society's 1985 ecological research, native observation challenged existing, published results by adding to suitable habitats known for a plant species. Inuit informants from Baker Lake countered an initial interpretation of site seasonality with one reflecting comprehensive consideration of seasonal variables (Bielawski and Kabloona 1985).

In theory, belief systems of other cultures may enrich rather than diminish the western scientific process. As scientists, we seek answers to unanswered questions, and explanations for unexplained phenomena. Presumably, we pursue all paths leading potentially to knowledge. The diversity of crosscultural knowledge may be akin to species diversity, in that it is a rich source for possible explanations. At the very least, it deserves protection just as endangered species do. Protection, however, is only the first required step. The exploration of cross-cultural knowledge could serve northern research, and may be achieved through the active involvement of indigenous people. Further steps are understanding, then building on to, the resource of cross-cultural knowledge. It is one part of a valuable whole possessed by the human species.

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XVII. People, Policy, and Practice: the Northwest Territories Approach to Renewable Resource Management

Hon. Nellie Cournoyea

Introduction

This paper is written from the perspective of a person born and raised in the Mackenzie River Delta of the Canadian Arctic, speaking on behalf of our people whose lives depend on the use of renewable resources.

In the history of mankind there has never been a period when people did not depend in some way upon their ability as hunters to contribute to their own survival, and that of their family or their people. Throughout North America and within the circumpolar region, hunters and trappers of all ethnic and racial backgrounds continue to develop and adapt new technology to perfect their skills in the harvest of wildlife.

In the Northwest Territories (NWT) we have been fortunate in that our resource-management practices have focused more and more on the involvement of our people in making decisions at the local and regional level. I say fortunate because we believe that, as users, if we do not have any say in the development of our wildlife management practices we, along with the animals, will become endangered. In these economic times, government and private foundations who were once willing to be more altruistic in providing monies are giving closer scrutiny to the value they are getting for their research dollar. By focusing on the people, and the species that are important as sources of nutrition, clothing, and for short-term small cash return, we are able to substantiate expenditures for population studies, habitat studies, and for sound measures to protect the environment. Again we are fortunate, for unlike the situation in southern Canada, our wildlife and our land is our life, our source of food, and our future.

The Setting

To begin, I would first like to give a brief overview of how we approach resource management in the NWT.

Although the Territorial Government has been managing wildlife since 1967, it was in 1979 that the Department of Renewable Resources was created during a departmental reorganization. The Department of Renewable Resources has the broad responsibility for wildlife management and environmental protection, powers transferred to the Government of the NWT by the Federal Parliament under the Northwest Territories Act. The objectives of the department may be summarized as the maximization of the long-term economic and social benefits of the renewable-resource base for northern residents. I should point out that the NWT is not yet a province. However, while still under the shadow of the federal government, the Government of the NWT is actively working to take over full responsibility for those normal provincial functions. This effort in itself will bring policy and decisionmaking closer to the people and to their elected government.

The NWT is experiencing rapid growth in non-renewable resource activities which, taken in conjunction with current constitutional evolution, has meant that the Department of Renewable Resources must operate in a highly dynamic environment. The challenge posed by the rapidly changing environment has motivated the department to seek means to better integrate resource-management functions. The timing is right: with land claims ongoing and constitutional development occurring, we are attempting to simplify the presently complex resource-management system that exists within the NWT.

People in the NWT rely on the wildlife resources of their land to a far greater extent than in other societies. Wildlife is a renewable resource that provides nutritious and inexpensive food as well as cash income for many NWT residents. Jobs and income are scarce in northern communities and many people live below the poverty line. Wildlife is one of the few resources available to people. In the Eastern and High Arctic, fish and wildlife are the only resources available and must form the basis of the local economy.

Balanced Development — What is it?

The concept of balanced development is politically very appealing, but what is it in real terms? We must recognize that the current impetus for change in the North, whether in terms of political evolution, the settlement of land claims, or non-renewable resource development, stems from the potential economic return from resource extraction. Is the development of oil and gas reserves in the Beaufort Sea, with transportation systems including Class 10 icebreaking tankers and major pipeline corridors moving hydrocarbons to the south, to be considered progress? Or does one consider the settlement of Native Land Claims to be progress toward "Northern Development"? The bottom line in determining what balanced development means is to determine how northern residents are affected. Balanced development must be defined by those people who will be affected by resource-development decisions.

Economic development in the NWT has focused almost exclusively on extractive or non-renewable resource based industries. This has been a driving force, generating the need for socio-economic development, the settlement of land claims, and political evolution in the north.

The people in the NWT, who live on a land mass that is one-third the size of Canada, have always realized how limited the benefits would be to them from such initiatives. For most of our people it is the continued access to wildlife harvests that gives focus to their lives, puts food on their tables, and provides enough cash to continue to use the north's wildlife.

The Department of Renewable Resources, and the Government of the NWT, were very concerned about the loss of the seal markets and, indeed, about the loss of any market. We are disturbed that outside foreign pressure groups who have lost contact with the natural world in their own countries can so severely affect the livelihoods of people who are close to nature. A vital source of income has been lost and local hunters are, in many cases, unable to finance much-needed hunting trips to provide food for themselves and their communities. Local communities have been damaged, lifestyles degraded, and people have been hurt by the negative protrayal of their hunting culture in the foreign and domestic urban media. We are concerned that aggressive international efforts by animal rights activists to curtail the markets for all wildlife products will continue to erode the culture and lifestyle of northern residents.

We believe it is imperative that these issues are addressed aggressively to ensure that unsuspecting nations are not misled by these emotional tactics and that they do not remain unaware that such tactics seriously undermine the ability of other nations to survive.

The Government of the NWT has clearly indicated its intentions to continue to stimulate the development of the renewable resource sector as a source of employment and income for those northern residents whose cultural ties, geographic preferences, or skills make them more amenable to traditional pursuits than to the wage economy. Furthermore, the Government of the NWT has set a goal of balanced development and early settlement of native claims. Within this dynamic external environment, the Department of Renewable Resources must meet its responsibilities to both the people and the northern environment. Through protection, enhancement, conservation, and management of the natural resource base, the Department is responsible for ensuring that existing resource-harvesting operations can be sustained.

Policy and Programme Initiatives — Ensuring Local Involvement in Policy Formulation and Implementation

Programmes of the Government of the NWT recognize the importance of resource harvesting. Through grants and contributions, assistance is provided to users to encourage further involvement in the management and the more efficient use of the local renewable-resource base. The Department's renewable resource development initiatives are guided by the following principles:

1. Renewable-resource use activities should be diverse to prevent over-use of a particular species and are directed to the social, cultural, and economic needs of NWT residents.

2. Locally based groups are encouraged to initiate and take an active role in developing renewable-resource use projects.

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3. Renewable-resource use activities are guided by established resource-management principles.

4. Renewable-resource use activities will be consistent with land-use policies and guidelines.

5. The public shall be assured of input and participation in decisions related to renewable-resource use activities.

We are convinced that by using this approach renewable resource development can occur in such a way that stocks are maintained and that people will continue to benefit from their use.

The Department's Grant and Contributions Policy, for example, supports this approach and provides financial assistance to individuals and recognized organizations which direct their efforts to enhancing the wise use of the renewable resources in the NWT. Within the Department of Renewable Resources alone three grants programmes exist. The first, Trapper Incentive Subsidies, includes a Sealskin Subsidy to offset low sealskin prices. Other Fur Subsidies and a Gasoline Subsidy offset the high northern energy costs of resource harvesters. The second programme is a Hunters and Trappers Disaster Compensation Policy for loss of cabins, equipment, etc., due to natural disasters. The third, for Humane Trap Development, is to provide incentives for further work in this area.

Contributions programmes within the Department include financial allocations to the following eleven areas:

1. Local Wildlife Committees
2. Outpost Camp Programme
3. Regional Wildlife Organizations
4. Trappers Assistance Loans
5. Wildlife Management Boards
6. Harvest Studies
7. Community-organized Hunts
8. Canadian Sealers Association
9. Community Harvester Assistance Programme
10. Renewable Resource Compensation Review Board
11. Fur Institute of Canada Support

Approximately $2.5 million from the Department of Renewable Resources is directed to assist and involve those who may be affected by management systems in the decisionmaking process.

The Government of the NWT is sincere about its commitment to resource users; the Territorial Government has been working to devolve resource management programmes to Hunters and Trappers Associations.

Another recent policy initiative is the Government of the NWT's Renewable Resource Compensation Policy. This policy requires that any developer proposing a major resource development project must prepare a detailed Compensation Plan that will be submitted and approved prior to the start of development. The Compensation Plan forms the basis of an agreement between the developer and the community or individual affected. This policy is based on the following principles:

1. Persons who are dependent upon or gain livelihood from the renewable-resource base require protection against the effects of non-renewable resource development on their property, on the renewable resources, and on their ability to harvest renewable resources.
2. Costs associated with the loss of renewable resources will be taken into account in the overall planning, design, and approval of resource development projects.
3. The resource developer is responsible for payment of costs associated with damages resulting from development activity.
4. Mitigation of such negative impacts to the renewable resource based economy is the first priority in managing the effects of development and is prerequisite to considering any compensation arrangements.

Within the Territorial Government, the Departments of Renewable Resources and Economic Development and Tourism have worked together to develop a Renewable Resource Use Policy. Through this policy the Government of the NWT will foster the development of renewable resource projects in the NWT by encouraging and supporting domestic/subsistence, commercial and outdoor recreational uses of renewable resources, within defined management goals. This umbrella policy is based on the following principles:

1. Renewable-resource use activities should be diverse to prevent over-use of particular species and will be directed to the social, cultural, and economic needs of NWT residents.
2. Locally based efforts are encouraged to initiate and take an active role in developing renewable-resource use projects.
3. Renewable-resource use activities are guided by established resource management principles.
4. Renewable-resource use activities will be consistent with land-use policies and guidelines.
5. The public shall be assured input and participation in decisions related to renewable-resource use activities.

Recently the Government of the NWT has been involved in negotiations with the federal government and native organizations in the NWT (the Dene Nation, the Tungavik Federation of Nunavut, the Committee for Original Peoples' Entitlement, and the Metis Association) to develop an agreement incorporating the principle structures and processes for a Land Use Planning programme. While this programme is only in its initial stages, staff of the Department of Renewable Resources have produced a draft document for discussion titled "Principles and Guidelines for Land Use Planning in the NWT." The purpose of this document is to provide a focus for discussion in order to develop a policy framework to guide decisions on the use of all land and resources within the NWT. The Land-Use Planning guidelines address:

1. Conservation and Environmental Protection;

2. Community Development;

3. Industrial Development;

4. Parks and Outdoor Recreation;

5. Transportation and Public Works

The draft document also suggests a process for Land-Use Planning.

While the Government of the NWT has not had the direct mandate and legal authority for resource management decisions related to land and water, we have taken the lead in initiating a more representative policy base for resource management in the north which better protects and represents the interests of northern residents.

NWT Experience in Involving People in Wildlife Management

The Department of Renewable Resources has long recognized that we cannot expect to develop and apply solutions to renewable-resource management issues without involving the users of the resources in question. For the most part, in the NWT, this refers to the Dene, Inuit, Inuvialuit, and Metis users as represented by community Hunters' and Trappers' Associations (HTAs), regional HTAs and other regional wildlife organizations such as the Keewatin Wildlife Federation and the Inuvialuit Game Council. A concerted effort is made to involve these organizations in wildlife management in as many ways as possible and to be responsive to their requests and requirements. Involvement in wildlife management at the local level starts at the planning stages of management and research studies through the review of Wildlife Research Permit applications. The local HTAs are given the opportunity to comment on and make recommendations on all proposed wildlife studies, including those conducted by outside researchers, prior to the issuance of a Wildlife Research Permit. Although approval from the HTAs is not required, their support is generally solicited and changes to the proposal or more detailed information on the proposal are often requested in order to obtain that support.

This involvement often continues into the fieldwork stage of the studies. Whenever possible, members of the HTAs are hired to assist with studies conducted by our Department. Other researchers are also encouraged to take advantage of the knowledge of the local resources that our people have. Our government recently initiated an affirmative action programme and it is hoped that this programme will further increase involvement at the field level and develop a pool of experienced native resource-management technicians and professionals.

The cooperation of local HTAs with our wildlife management programmes has extended to the level of making voluntary restrictions of hunting activities in response to resource-management problems. The most recent example occurred on the northeast coast of Baffin Island where management studies indicated that the harvest of polar bears by the communities of Clyde River and Broughton Island was higher than that which could be sustained by the bear population. Once the problem was outlined the two communities agreed to reduce their polar bear quotas and to change their hunting activities to protect the reproductive segment of the population.

Similar self-regulation of hunting activities took place along the Liard Highway where hunters in the south Mackenzie area agreed not to hunt moose along the highway in order to prevent local over harvesting. On Bathurst Island the hunters from Resolute Bay agreed not to hunt Peary caribou in order to allow the population to recover from winter die-offs. In the latter two cases regulations to restrict the hunting activities of non-native hunters were also applied.

Regional wildlife organizations as well as local HTAs have been active in the collection of wildlife harvest information. In the three harvest studies implemented to date, the regional organizations have been reponsible for the coordination of the study and collection of harvest data. In two of the studies they were also responsible for the data analysis. The local HTAs play a role in promoting the study, ensuring participation and in recruiting fieldworkers to collect harvest information.

The users of the renewable resources in the NWT are also involved in the management of those resources at higher levels. The Department has encouraged the involvement of regional wildlife organizations on the national and international fronts. At the national level, regional wildlife organizations have been involved in the management of the Beverly and Kaminuriak caribou herds and the Porcupine caribou herd. At the international level they have been involved in discussions on the management of the North Slope/Beaufort Sea polar bear population, in counter-lobbying the anti-trapping and anti-sealing groups, and have participated in the last two CITES meetings.

We have found that cooperative management is enhanced by ensuring the involvement of the users at all levels. This approach is expected to develop further as land claims progress and the involvement of the users in resource management moves from the policy field to become enshrined in legislation.

Renewable Resource Development

As well as identifying areas where there may be problems with resource harvesting, the Department identifies areas where there is the potential for increased utilization of a resource and economic opportunities associated with that resource. The Department will then provide support for efforts to take advantage of those opportunities.

Under the Natural Resources sub-agreement of the Canada/Northwest Territories Agreement, money is available for feasibility studies, product development and test marketing designed to enhance renewable resource use. Over the last 3 years, $3.2 million dollars has been spent on projects which have included: muskox harvesting; development of country foods; start-up of char fisheries; fur farming; trapper training; sawmill development; muskrat and beaver enhancement; and testing the feasibility of using sealskin as a leather product.

Conclusion

Renewable-resource use activities are governed by biological, economic, cultural, and ethical principles. Biologically, the maintenance of our wildlife populations is paramount; if our resources are depleted no harvest is possible. Economically, we recognize that renewable resources are extremely important to the maintenance of communities, be it wood for fuel, caribou for meat, or furbearers as a source of cash income. Culturally, the heritage of northern people is still based on the practice of harvesting wildlife. In fact, the native culture is defined by the relationship to the land and those resources that developed and supported the varied lifestyles and culture of the Dene, Inuit, Inuvialuit, and Metis of the NWT. Because our people live so closely with the land, the welfare of wildlife is of paramount importance to them. Our hunters and trappers have insisted on stringent environmental-protection measures for all hydrocarbon and mineral-development activities. These measures ensure that the resources are maintained and a way of life is preserved.

It is ironic that often our people, who live so close to the land, are being affected by a people who are far removed from a lifestyle based on a natural environment, such as animal rights groups, and the developers of the mining and petroleum industry. However, the Government of the NWT is working hard to assist and involve organizations such as Hunters and Trappers Associations directly in those resource-management decisions that affect them and in some cases has devolved entire programmes to the local community level. For example, the Community Harvesters' Assistance Programme, cited earlier, gives the decisionmaking power to local wildlife committees regarding the allocation of funds in their communities variously to outpost camp programmes, trappers' assistance loans, and community-organized hunts.

The renewable resource sector can provide opportunities for not only long-term, low-level stable development (such as small-scale commercial fishing, hunting, logging, and agriculture for intersettlement trade and export) but also the development of secondary industries (marketing, processing, fur tanning, garment manufacturing, food processing, log and lumber construction, saw milling, handicrafts, and other small industries).

For most small communities and almost all native peoples, renewable-resource harvesting represents the only indigenous source of wealth. Success in developing these resources will strengthen the territorial economy and lessen its dependence on the skills, welfare, unemployment insurance, and other resources imported from the southern part of Canada.

When I refer to balanced resource development and the maintenance of northern renewable resources, what is meant is that northerners, and in particular the local native people, must be involved in the decisionmaking process when it is related to the use of land and resources.

I hope this paper has provided a better understanding of the Government of the NWT's efforts to involve people both, in policy and practice in the resource management decisionmaking process.

XVIII. The Inuit Perspective

Finn Lynge

Going to conferences abroad, one always stands a chance of learning something new. I for my part learned something new yesterday: the word, or the concept, of political ecology. How true were the insights of Professor Per Mathiessen of Norway, referring to ecology as not only a question of relationship between nature and nature or between man and nature, but an interplay of man-man-nature, a criss-cross between these three elements. Conflicting views between men, and conflicting attitudes toward nature, are often highly significant to what actually happens to nature. Political ecology: that is what our most crucial affairs are all about in the Arctic. If you want to deal with the question of the balance of nature in this part of the world, and the encroachments of man-made environments, then you must also deal with the encroachments of southern man upon the lifestyle of Arctic man.

There is, around the world, a growing awareness that in the long run, you cannot get around dealing with the issues raised by the so-called Fourth World aboriginal people — people living in a traditional lifestyle, close to nature, on the lands of their forefathers, and oftentimes fatally encroached upon by industrial societies on the move. There are a great many examples. The Australian aborigines, the Maoris of New Zealand, the Sami of Northern Scandinavia, the Indians of the Americas, the Inuit, and others. The understanding of the special rights of these people is slow in coming. They have invariably been either incorporated by the aggressive newcomers' society, or immobilized in some impossible corner of the land, or appeased by mission and trade into an attitude of total collaboration.

One trait is common for them all: they are distinct peoples on distinct lands with distinct traditions — but never recognized as such.

The northern peoples' own consciousness of their distinct rights never has been extinguished. And now, a new situation is evolving: the struggle for these rights is being openly and expressly sponsored by the Human Rights Division of the United Nations. This, among other things, gives us hope for the future.

The general attitude of the encroaching societies has always been one of missionizing. I am not here talking so much about the directly religious missions as such. They are mostly respectable undertakings with the clear and honest objective of wanting to change people's minds in some basic matters. They are missionaries, and they make no bones about it. No, I am thinking of the undeclared, condescending attitude of cultural "missionizing" on the part of educators, tradesmen, and administrators.

The governing establishments of the South have always in their dealings with the Northlands been motivated by economic profit and/or political control, coupled with the assumption that the aboriginal people of the North are simply unable to cope ....

At one point, the famous playwright Bernard Shaw took exception with the Holy Scripture, namely where it is said: "Do unto others what you would want others to do unto you." No! says Shaw. Shaping others in your own image isn't necessarily the best thing you can do. Everybody's taste is different! How right he was. Why should Inuit boarding school children be fed canned beef and chicken legs, if they really do prefer mattak and frozen fish? Certainly not because the former is healthier than the latter, on the contrary! There is only one explanation, and we all know it: cultural imperialism. The students must be shaped in the white man's ways, even if it should prove necessary to make them despise their own traditional and healthy foodstuffs.

Imposing on others — is that an inevitable phenomenon whenever big is faced with small, and strong is faced with weak? I've been told that it is inevitable, that we may as well all take it in stride. I refuse to believe it. If it were so, the Universal Declaration on Human Rights would be an empty exercise, a worthless inanity. Is it? Our governments have all signed the Human Rights Charter, and I, for one, refuse to believe that they all did it in bad faith.

Yet, imposing on others occurs; the fact is there.

The following is a striking example of this type of cultural imperialism. For centuries, the aboriginal Norse population of the Faroe Islands have hunted the pilot whale. When a

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school of these small whales gets too close to land, they are herded into shallow water and killed with knives. The pilot whale has always provided fresh meat and blubber, protein and vitamin C for the Faroese, and the hunt has never come close to threatening the species. Nevertheless, this type of hunt is now being severely criticized by environmental activist groups, and has been obstructed by activist motorboats and rubber-rafts for being ... blood-thirsty!

The real problem of the Faroese is the invention of coloured television. The hunting down of a school of pilot whales, the butchering in the shallows, the sea-water slowly turning red — all this apparently makes a tremendous impression on the average TV-viewer in Europe. The urbanites have their own animal butchering done for them behind closed doors, they never see animal blood, and know about these "facts of life" only from the neatly wrapped merchandise in the supermarkets' coldstores. They act, think, and, above all, feel as if the spilling of animal blood didn't take place and ought not to take place. Therefore, when seeing on television, in crimson-red colours, whale blood being spilled in the water, their indignation knows no bounds. Stop it! is the reaction.

Cultural imperialism it is. Why is it that western industrial culture, or actually the Indo-European/North American ways, display this tireless, ever continuing effort to shape the entire world according to its own image? Why can't the Europeans let the Faroese alone? Why must they come down upon every little human society that thinks and acts differently from their own, and try to force them into their ways? Why this interminable missionizing?

Indo-European/North American civilization suffers from a colonizer's syndrome. It is the seemingly uneradicable strand of *colonialistic attitudes*, running through the entire fabric of western civilization, which creates so many problems.

The words colony, colonize, and colonial have greatly changed their emotional value within the last generation. My grandfather was a colonial manager, "kolonibestyrer," in Greenland up until the 1930s. At the time, that was a most respectable thing to be. Today, nobody in Greenland would want to be called a "colonial manager." Not that certain attitudes don't persist, but the rhetoric has greatly changed.

In the face of this, what is our challenge?

First, let me be precise. By "our" I mean unto us, the Inuit, the true Northerners.

Our challenge is first and foremost to decolonize ourselves. Formally, our land is no longer a colony, so we are told. What the actual facts are, we know. We are facing a white man's governing establishment, which in its ingrained attitudes is very colonialistic indeed. That cannot be changed; we can, however, change ourselves. We must decolonize our own minds. We still have among us entirely too many people who bow to every word and wish that proceeds from the mouth of a white/southern establishment representative. We suffer from a colonized mind.

We cannot change the colonialistic attitudes of the white man. After all, that's part of his nature. But we *can* see to it that his colonialistic measures meet with a stone wall. And it is about time. Besides, we'd be doing the entire society a favour. After all, decolonizing the mind ought to be for everyone.

It is important for scientists and administrators to ask themselves whether they are a part of this game. Are they operative — consciously or not — in political forces that aim, in a distant future, at the extinction of the aboriginal peoples as distinct groups? Or do they support forces that try to pull development in the opposite direction?

What is at stake here is one of the truly great remaining hunting cultures of the world. Is it going to become extinct, eventually, or is it going to survive, and stay with mankind, for the generations and centuries ahead?

For us, the natives of the North, there is, of course, no doubt in our minds. Our hunting culture is here to stay in some form or other, and it is of great importance to everybody that it stay. It is important for the good reason that we seem to be one of the few remaining groups of humans that retain a healthy attitude toward nature and animals. We see our attitudes beleaguered by people to whom the sight of animal blood is taboo, while they themselves wallow in human blood in their cinemas and on their TV screens for entertainment! To us, this is distasteful, to say the least.

Our identity, the identity of man as a hunter, is that of man, of *Homo sapiens*, all around the globe for untold hundreds of thousands of years. It is only during the last few minutes — I'd even say seconds — of the totality of the history of man that these unnatural attitudes have surfaced as a by-product of urban civilization, wed to the big technocratic machine and ready to obliterate what's left of the *natural Homo sapiens. That must not happen!*

Hunter-man, in order to survive, needs a solid grip upon the basic elements of this planet of ours, somewhere on one of the five continents. He needs a place to be, a place that's his. That place is the Arctic. That is the Inuit homeland.

The Arctic will be developed. We need development. We welcome development — *but* on our terms.

The Arctic is not a backyard of the South. The Arctic is not a wasteland which you can handle at will. The Arctic is not just the supreme challenge for technology and industry, on their terms.

The Arctic is a living creature all by itself, a living, pulsating thing which you have to understand, respect and serve. It has served mankind for millennia, and the global ecological balance for as far back as anybody cares to think. Now time has come *for us* to *serve it*.

How, then, do we serve the Arctic?

We do first of all by understanding that the balance between conservation and development in the Arctic is of a different nature compared with more southerly latitudes. In the industrialized part of the world, as well as in the Third World countries, overexploitation of resources and the general pollution of the environment has reached such dimensions that industrial growth is being threatened by its very own pace. This is why more and more people are beginning to realize that somebody *must* throw on the brakes, for the sake of industrial development itself. Development must be graded down to a level where it becomes sustainable. The natural resource bases of most industries have reached or are reaching a stage where nobody can afford a boom-and-bust development strategy.

This is why the IUCN, in its headquarters in Switzerland, has created the CDC — Conservation for Development Centre. Industrial growth and development simply cannot continue in the indefinite future without introducing a conservationist element. Conservation and development go hand in hand, and to an increasing degree, one is going to function as an indispensible premise for the other. This is what the CDC and the IUCN are trying to make developers understand, maybe especially in the Third World countries.

However, this concept doesn't work for the Arctic. Conservationist measures in the Inuit homeland cannot be structured merely as bases, safeguards and props for a supposed industrial development to come. The Arctic is, above all, Inuit land, and Inuit don't want an all-out industrialization any time in the future, neither of their land nor of their communities. That has to be respected. What we want is to keep our hunting grounds with a sufficient and sustained abundance of wildlife for future generations to keep up the basics of our culture and traditions. Agreed, development of the Arctic is necessary, and we want it. But it is absolutely imperative that we avoid the kind of rape of the land which can be witnessed in many Third World countries today.

So the motto for the Arctic is not Conservation for Development, but rather inversely, Development for Conservation.

Conservation of our land and water has first priority. Whatever can be termed development — industrially, socially, culturally — must see to it that it doesn't ultimately militate against the Inuit, his culture and his land. Things will change, we will change; our way of life has changed greatly and will keep changing, our land is being and will be affected by new activities. But the core of our culture has not changed, and enormous stretches of our land and water remain virtually unaffected. The Inuk is the hunter-man *par excellence*, the human community at large needs to have this style of life within sight in order not to forget its own roots, ecological and environmental activists in the industrialized countries need to have this living and concrete example of a sound and aboriginal balance between man and nature present in front of them — and: *we refuse to die out*.

An ecological and environmental strategy for the Arctic has to start out from here: the Inuit culture must be respected and must survive. This is not just one element in a mosaic

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of objectives, to be fitted in where it doesn't contravene the interests of industry. It is *the* basis and *the* goal of it all. All other interests have to bow to this principle. Otherwise things don't make sense.

The academic world of today is obviously different from that of yesteryear. It is in the academic world of today — as opposed to that of the governing establishment or industry — that one finds a truly solid base for a sound development *vis-à-vis* the Arctic and its people. I will conclude by listing some practical recommendations.

Whenever possible, please involve the local people in regular scientific activities. The work of the Arctic Research Establishment, in Pond Inlet, shows what can be accomplished along this line.

Communication in the Arctic, be it airlines, mail routes, telephone systems or shipping, has traditionally been organized in south-north corridors, with scant or no communications crosswise between the Arctic regions themselves. There is a growing effort throughout the Arctic to break down this system and have neighbour be acquainted with neighbour. The scientific community has great stakes in cross-boundary communication. It is amazing how many Arctic conferences have been held around the world over the years, all kinds of places — except in the Arctic itself. In the future, when phenomena of the land of glaciers and tundra are debated, it should be done in that land itself. It is not only possible, but actually quite pleasant, to meet on Inuit ground.

Finally, it is important to beware of non-scientific pressure within scientific work groups. There has been a steady degradation of the scientific value of the work being done in such respected international organs as CITES and IWC, clearly because of propaganda-type pressure from environmental activist groups. It is not in the interest of scientists that respected international bodies be eroded and lose scientific credibility. And it is not in our interest to see these same bodies transformed into instruments increasingly apt and likely to try to liquidate our way of life.

Whatever scientists do, they must not carry out the errand of the one-eyed environmental activists! We all have the right to be here.

Appendix I
1984 United States Arctic Research and Policy Act

PUBLIC LAW 98-373—JULY 31, 1984

ARCTIC RESEARCH AND POLICY ACT OF 1984

Public Law 98-373
98th Congress

An Act

July 31, 1984
[S. 373]

To provide for a comprehensive national policy dealing with national research needs and objectives in the Arctic, for a National Critical Materials Council, for development of a continuing and comprehensive national materials policy, for programs necessary to carry out that policy, including Federal programs of advanced materials research and technology, and for innovation in basic materials industries, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Arctic Research and Policy Act of 1984.

TITLE I—ARCTIC RESEARCH AND POLICY

SHORT TITLE

15 USC 4101 note.

SEC. 101. This title may be cited as the "Arctic Research and Policy Act of 1984".

FINDINGS AND PURPOSES

15 USC 4101.

SEC. 102. (a) The Congress finds and declares that—

(1) the Arctic, onshore and offshore, contains vital energy resources that can reduce the Nation's dependence on foreign oil and improve the national balance of payments;

(2) as the Nation's only common border with the Soviet Union, the Arctic is critical to national defense;

(3) the renewable resources of the Arctic, specifically fish and other seafood, represent one of the Nation's greatest commercial assets;

(4) Arctic conditions directly affect global weather patterns and must be understood in order to promote better agricultural management throughout the United States;

(5) industrial pollution not originating in the Arctic region collects in the polar air mass, has the potential to disrupt global weather patterns, and must be controlled through international cooperation and consultation;

(6) the Arctic is a natural laboratory for research into human health and adaptation, physical and psychological, to climates of extreme cold and isolation and may provide information crucial for future defense needs;

(7) atmospheric conditions peculiar to the Arctic make the Arctic a unique testing ground for research into high latitude communications, which is likely to be crucial for future defense needs;

(8) Arctic marine technology is critical to cost-effective recovery and transportation of energy resources and to the national defense;

(9) the United States has important security, economic, and environmental interests in developing and maintaining a fleet of icebreaking vessels capable of operating effectively in the heavy ice regions of the Arctic;

(10) most Arctic-rim countries, particularly the Soviet Union, possess Arctic technologies far more advanced than those currently available in the United States;

(11) Federal Arctic research is fragmented and uncoordinated at the present time, leading to the neglect of certain areas of research and to unnecessary duplication of effort in other areas of research;

(12) improved logistical coordination and support for Arctic research and better dissemination of research data and information is necessary to increase the efficiency and utility of national Arctic research efforts;

(13) a comprehensive national policy and program plan to organize and fund currently neglected scientific research with respect to the Arctic is necessary to fulfill national objectives in Arctic research;

(14) the Federal Government, in cooperation with State and local governments, should focus its efforts on the collection and characterization of basic data related to biological, materials, geophysical, social, and behavioral phenomena in the Arctic;

(15) research into the long-range health, environmental, and social effects of development in the Arctic is necessary to mitigate the adverse consequences of that development to the land and its residents;

(16) Arctic research expands knowledge of the Arctic, which can enhance the lives of Arctic residents, increase opportunities for international cooperation among Arctic-rim countries, and facilitate the formulation of national policy for the Arctic; and

(17) the Alaskan Arctic provides an essential habitat for marine mammals, migratory waterfowl, and other forms of wildlife which are important to the Nation and which are essential to Arctic residents.

(b) The purposes of this title are—

(1) to establish national policy, priorities, and goals and to provide a Federal program plan for basic and applied scientific research with respect to the Arctic, including natural resources and materials, physical, biological and health sciences, and social and behavioral sciences;

(2) to establish an Arctic Research Commission to promote Arctic research and to recommend Arctic research policy;

(3) to designate the National Science Foundation as the lead agency responsible for implementing Arctic research policy; and

(4) to establish an Interagency Arctic Research Policy Committee to develop a national Arctic research policy and a five year plan to implement that policy.

ARCTIC RESEARCH COMMISSION

Establishment.

15 USC 4102.

SEC. 103. (a) The President shall establish an Arctic Research Commission (hereafter referred to as the "Commission").

(b)(1) The Commission shall be composed of five members appointed by the President, with the Director of the National Science Foundation serving as a nonvoting, ex officio member. The members appointed by the President shall include—

(A) three members appointed from among individuals from academic or other research institutions with expertise in areas of research relating to the Arctic, including the physical, biological, health, environmental, social, and behavioral sciences;

(B) one member appointed from among indigenous residents of the Arctic who are representative of the needs and interests of Arctic residents and who live in areas directly affected by Arctic resource development; and

(C) one member appointed from among individuals familiar with the Arctic and representative of the needs and interests of private industry undertaking resource development in the Arctic.

(2) The President shall designate one of the appointed members of the Commission to be chairperson of the Commission.

(c)(1) Except as provided in paragraph (2) of this subsection, the term of office of each member of the Commission appointed under subsection (b)(1) shall be four years.

(2) Of the members of the Commission originally appointed under subsection (b)(1)—

(A) one shall be appointed for a term of two years;

(B) two shall be appointed for a term of three years; and

(C) two shall be appointed for a term of four years.

(3) Any vacancy occurring in the membership of the Commission shall be filled, after notice of the vacancy is published in the Federal Register, in the manner provided by the preceding provisions of this section, for the remainder of the unexpired term.

(4) A member may serve after the expiration of the member's term of office until the President appoints a successor.

(5) A member may serve consecutive terms beyond the member's original appointment.

(d)(1) Members of the Commission may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by section 5703 of title 5, United States Code. A member of the Commission not presently employed for compensation shall be compensated at a rate equal to the daily equivalent of the rate for GS-16 of the General Schedule under section 5332 of title 5, United States Code, for each day the member is engaged in the actual performance of his duties as a member of the Commission, not to exceed 90 days of service each year. Except for the purposes of chapter 81 of title 5 (relating to compensation for work injuries) and chapter 171 of title 28 (relating to tort claims), a member of the Commission shall not be considered an employee of the United States for any purpose.

5 USC 8101 et seq.
28 USC 2671 et seq.

(2) The Commission shall meet at the call of its Chairman or a majority of its members.

(3) Each Federal agency referred to in section 107(b) may designate a representative to participate as an observer with the Commission. These representatives shall report to and advise the Commission on the activities relating to Arctic research of their agencies.

Public meeting.

(4) The Commission shall conduct at least one public meeting in the State of Alaska annually.

DUTIES OF COMMISSION

15 USC 4103.

Sec. 104. (a) The Commission shall—

(1) develop and recommend an integrated national Arctic research policy;

(2) in cooperation with the Interagency Arctic Research Policy Committee established under section 107, assist in establishing a national Arctic research program plan to implement the Arctic research policy;

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(3) facilitate cooperation between the Federal Government and State and local governments with respect to Arctic research;

(4) review Federal research programs in the Arctic and suggest improvements in coordination among programs;

(5) recommend methods to improve logistical planning and support for Arctic research as may be appropriate and in accordance with the findings and purposes of this title;

(6) suggest methods for improving efficient sharing and dissemination of data and information on the Arctic among interested public and private institutions;

(7) offer other recommendations and advice to the Interagency Committee established under section 107 as it may find appropriate; and

(8) cooperate with the Governor of the State of Alaska and with agencies and organizations of that State which the Governor may designate with respect to the formulation of Arctic research policy.

(b) Not later than January 31 of each year, the Commission shall—

(1) publish a statement of goals and objectives with respect to Arctic research to guide the Interagency Committee established under section 107 in the performance of its duties; and

(2) submit to the President and to the Congress a report describing the activities and accomplishments of the Commission during the immediately preceding fiscal year. Report.

COOPERATION WITH THE COMMISSION

SEC. 105. (a)(1) The Commission may acquire from the head of any Federal agency unclassified data, reports, and other nonproprietary information with respect to Arctic research in the possession of the agency which the Commission considers useful in the discharge of its duties. 15 USC 4104.

(2) Each agency shall cooperate with the Commission and furnish all data, reports, and other information requested by the Commission to the extent permitted by law; except that no agency need furnish any information which it is permitted to withhold under section 552 of title 5, United States Code. Confidentiality.

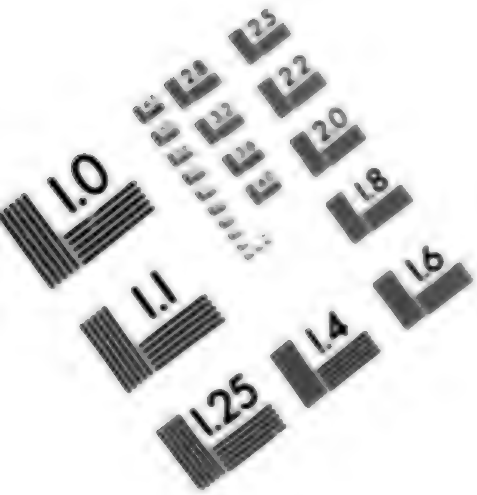
(b) With the consent of the appropriate agency head, the Commission may utilize the facilities and services of any Federal agency to the extent that the facilities and services are needed for the establishment and development of an Arctic research policy, upon reimbursement to be agreed upon by the Commission and the agency head and taking every feasible step to avoid duplication of effort.

(c) All Federal agencies shall consult with the Commission before undertaking major Federal actions relating to Arctic research.

ADMINISTRATION OF THE COMMISSION

SEC. 106. The Commission may— 15 USC 4105.

(1) in accordance with the civil service laws and subchapter III of chapter 53 of title 5, United States Code, appoint and fix the compensation of an Executive Director and necessary additional staff personnel, but not to exceed a total of seven compensated personnel; 5 USC 5331.



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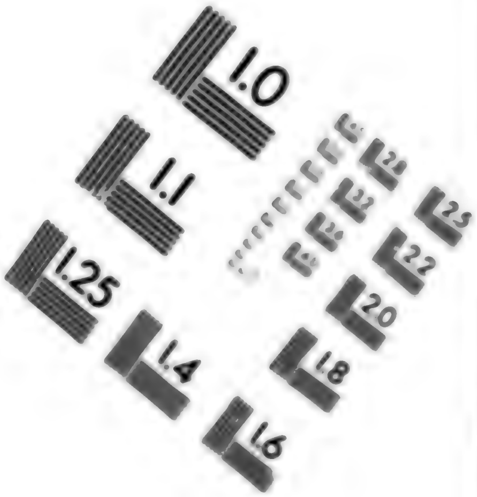

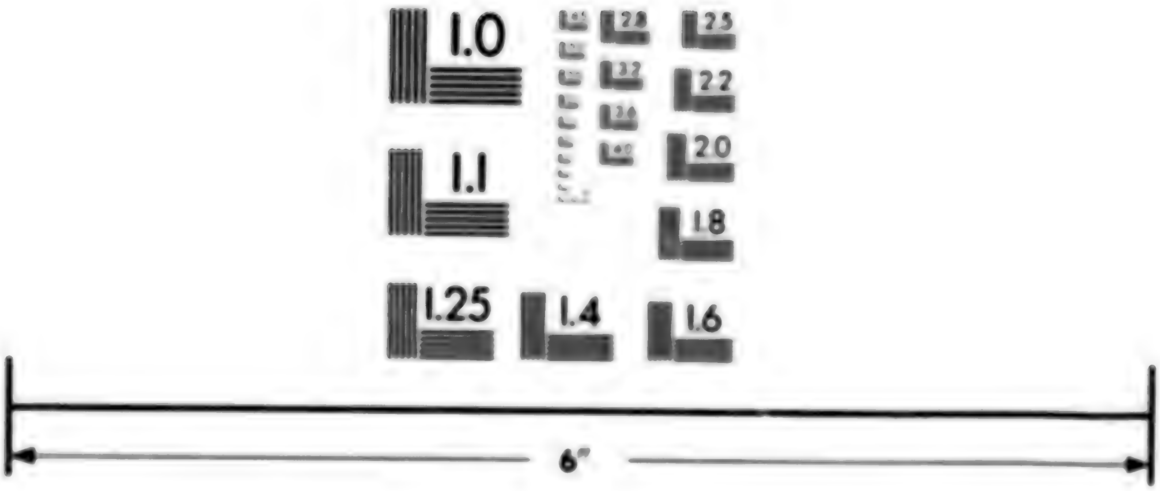

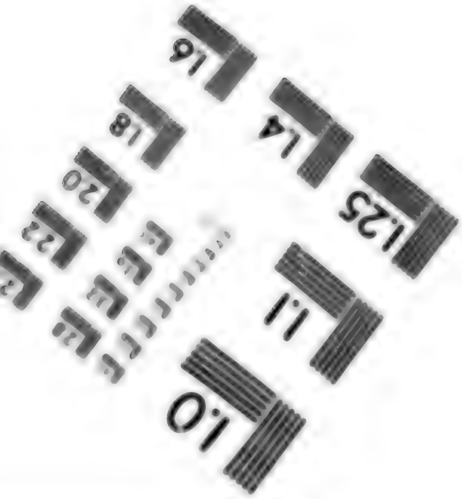

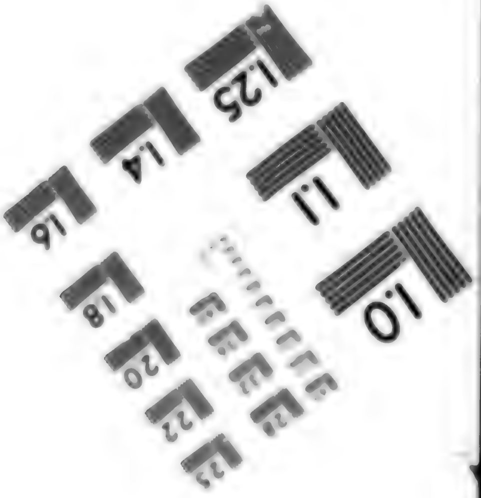

(2) procure temporary and intermittent services as authorized by section 3109 of title 5, United States Code;

(3) enter into contracts and procure supplies, services, and personal property; and

(4) enter into agreements with the General Services Administration for the procurement of necessary financial and administrative services, for which payment shall be made by reimbursement from funds of the Commission in amounts to be agreed upon by the Commission and the Administrator of the General Services Administration.

LEAD AGENCY AND INTERAGENCY ARCTIC RESEARCH POLICY COMMITTEE

15 USC 4106. SEC. 107. (a) The National Science Foundation is designated as the lead agency responsible for implementing Arctic research policy, and the Director of the National Science Foundation shall insure that the requirements of section 108 are fulfilled.

Establishment. (b)(1) The President shall establish an Interagency Arctic Research Policy Committee (hereinafter referred to as the "Interagency Committee").

(2) The Interagency Committee shall be composed of representatives of the following Federal agencies or offices:

- (A) the National Science Foundation;
- (B) the Department of Commerce;
- (C) the Department of Defense;
- (D) the Department of Energy;
- (E) the Department of the Interior;
- (F) the Department of State;
- (G) the Department of Transportation;
- (H) the Department of Health and Human Services;
- (I) the National Aeronautics and Space Administration;
- (J) the Environmental Protection Agency; and
- (K) any other agency or office deemed appropriate.

(3) The representative of the National Science Foundation shall serve as the Chairperson of the Interagency Committee.

DUTIES OF THE INTERAGENCY COMMITTEE

15 USC 4107. SEC. 108. (a) The Interagency Committee shall—

(1) survey Arctic research conducted by Federal, State, and local agencies, universities, and other public and private institutions to help determine priorities for future Arctic research, including natural resources and materials, physical and biological sciences, and social and behavioral sciences;

(2) work with the Commission to develop and establish an integrated national Arctic research policy that will guide Federal agencies in developing and implementing their research programs in the Arctic;

(3) consult with the Commission on—

(A) the development of the national Arctic research policy and the 5-year plan implementing the policy;

(B) Arctic research programs of Federal agencies;

(C) recommendations of the Commission on future Arctic research; and

(D) guidelines for Federal agencies for awarding and administering Arctic research grants;

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(4) develop a 5-year plan to implement the national policy, as provided for in section 109;

(5) provide the necessary coordination, data, and assistance for the preparation of a single integrated, coherent, and multiagency budget request for Arctic research as provided for in section 110;

(6) facilitate cooperation between the Federal Government and State and local governments in Arctic research, and recommend the undertaking of neglected areas of research in accordance with the findings and purposes of this title;

(7) coordinate and promote cooperative Arctic scientific research programs with other nations, subject to the foreign policy guidance of the Secretary of State;

(8) cooperate with the Governor of the State of Alaska in fulfilling its responsibilities under this title;

(9) promote Federal interagency coordination of all Arctic research activities, including—

(A) logistical planning and coordination; and

(B) the sharing of data and information associated with Arctic research, subject to section 552 of title 5, United States Code; and

Public information.

(10) provide public notice of its meetings and an opportunity for the public to participate in the development and implementation of national Arctic research policy.

Report.

(b) Not later than January 31, 1986, and biennially thereafter, the Interagency Committee shall submit to the Congress through the President, a brief, concise report containing—

(1) a statement of the activities and accomplishments of the Interagency Committee since its last report; and

(2) a description of the activities of the Commission, detailing with particularity the recommendations of the Commission with respect to Federal activities in Arctic research.

5-YEAR ARCTIC RESEARCH PLAN

15 USC 4108.

SEC. 109. (a) The Interagency Committee, in consultation with the Commission, the Governor of the State of Alaska, the residents of the Arctic, the private sector, and public interest groups, shall prepare a comprehensive 5-year program plan (hereinafter referred to as the "Plan") for the overall Federal effort in Arctic research. The Plan shall be prepared and submitted to the President for transmittal to the Congress within one year after the enactment of this Act and shall be revised biennially thereafter.

(b) The Plan shall contain but need not be limited to the following elements:

(1) an assessment of national needs and problems regarding the Arctic and the research necessary to address those needs or problems;

(2) a statement of the goals and objectives of the Interagency Committee for national Arctic research;

(3) a detailed listing of all existing Federal programs relating to Arctic research, including the existing goals, funding levels for each of the 5 following fiscal years, and the funds currently being expended to conduct the programs;

(4) recommendations for necessary program changes and other proposals to meet the requirements of the policy and goals

as set forth by the Commission and in the Plan as currently in effect; and

(5) a description of the actions taken by the Interagency Committee to coordinate the budget review process in order to ensure interagency coordination and cooperation in (A) carrying out Federal Arctic research programs, and (B) eliminating unnecessary duplication of effort among these programs.

COORDINATION AND REVIEW OF BUDGET REQUESTS

15 USC 4109.

SEC. 110. (a) The Office of Science and Technology Policy shall—

(1) review all agency and department budget requests related to the Arctic transmitted pursuant to section 108(a)(5), in accordance with the national Arctic research policy and the 5-year program under section 108(a)(2) and section 109, respectively; and

(2) consult closely with the Interagency Committee and the Commission to guide the Office of Science and Technology Policy's efforts.

Report.

(b)(1) The Office of Management and Budget shall consider all Federal agency requests for research related to the Arctic as one integrated, coherent, and multiagency request which shall be reviewed by the Office of Management and Budget prior to submission of the President's annual budget request for its adherence to the Plan. The Commission shall, after submission of the President's annual budget request, review the request and report to Congress on adherence to the Plan.

(2) The Office of Management and Budget shall seek to facilitate planning for the design, procurement, maintenance, deployment, and operations of icebreakers needed to provide a platform for Arctic research by allocating all funds necessary to support icebreaking operations, except for recurring incremental costs associated with specific projects, to the Coast Guard.

AUTHORIZATION OF APPROPRIATIONS; NEW SPENDING AUTHORITY

15 USC 4110.

SEC. 111. (a) There are authorized to be appropriated such sums as may be necessary for carrying out this title.

2 USC 651.

(b) Any new spending authority (within the meaning of section 401 of the Congressional Budget Act of 1974) which is provided under this title shall be effective for any fiscal year only to such extent or in such amounts as may be provided in appropriation Acts.

DEFINITION

15 USC 4111.

SEC. 112. As used in this title, the term "Arctic" means all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering, and Chukchi Seas; and the Aleutian chain.

National Critical Materials Act of 1984.

TITLE II—NATIONAL CRITICAL MATERIALS ACT OF 1984

SHORT TITLE

30 USC 1801 note.

SEC. 201. This title may be cited as the "National Critical Materials Act of 1984".

FINDINGS AND PURPOSES

SEC. 202. (a) The Congress finds that— 30 USC 1801.

(1) the availability of adequate supplies of strategic and critical industrial minerals and materials continues to be essential for national security, economic well-being, and industrial production;

(2) the United States is increasingly dependent on foreign sources of materials and vulnerable to supply interruption in the case of many of those minerals and materials essential to the Nation's defense and economic well-being;

(3) together with increasing import dependence, the Nation's industrial base, including the capacity to process minerals and materials, is deteriorating—both in terms of facilities and in terms of a trained labor force;

(4) research, development, and technological innovation, especially related to improved materials and new processing technologies, are important factors which affect our long-term capability for economic competitiveness, as well as for adjustment to interruptions in supply of critical minerals and materials;

(5) while other nations have developed and implemented specific long-term research and technology programs to develop high-performance materials, no such policy and program evolution has occurred in the United States;

(6) establishing critical materials reserves, by both the public and private sectors and with proper organization and management, represents one means of responding to the genuine risks to our economy and national defense from dependency on foreign sources;

(7) there exists no single Federal entity with the authority and responsibility for establishing critical materials policy and for coordinating and implementing that policy; and

(8) the importance of materials to national goals requires an organizational means for establishing responsibilities for materials programs and for the coordination, within and at a suitably high level of the Executive Office of the President, with other existing policies within the Federal Government.

(b) It is the purpose of this title—

(1) to establish a National Critical Materials Council under and reporting to the Executive Office of the President which shall—

(A) establish responsibilities for and provide for necessary coordination of critical materials policies, including all facets of research and technology, among the various agencies and departments of the Federal Government, and make recommendations for the implementation of such policies;

(B) bring to the attention of the President, the Congress, and the general public such materials issues and concerns, including research and development, as are deemed critical to the economic and strategic health of the Nation; and

(C) ensure adequate and continuing consultation with the private sector concerning critical materials, materials research and development, use of materials, Federal materials policies, and related matters;

(2) to establish a national Federal program for advanced materials research and technology, including basic phenomena through processing and manufacturing technology; and

(3) to stimulate innovation and technology utilization in basic as well as advanced materials industries.

ESTABLISHMENT OF THE NATIONAL CRITICAL MATERIALS COUNCIL

30 USC 1802. SEC. 203. There is hereby established a National Critical Materials Council (hereinafter referred to as the "Council") under and reporting to the Executive Office of the President. The Council shall be composed of three members who shall be appointed by the President and who shall serve at the pleasure of the President. Members so appointed who are not already Senate-confirmed officers of the Government shall be appointed by and with the advice and consent of the Senate. The President shall designate one of the members to serve as Chairman. Each member shall be a person who, as a result of training, experience, and achievement, is qualified to carry out the duties and functions of the Council, with particular emphasis placed on fields relating to materials policy or materials science and engineering. In addition, at least one of the members shall have a background in and understanding of environmentally related issues.

RESPONSIBILITIES AND AUTHORITIES OF THE COUNCIL

30 USC 1803. SEC. 204. (a) It shall be the primary responsibility of the Council—

(1) to assist and advise the President in establishing coherent national materials policies consistent with other Federal policies, and making recommendations necessary to implement such policies;

(2) to assist in establishing responsibilities for, and to coordinate, Federal materials-related policies, programs, and research and technology activities, as well as recommending to the Office of Management and Budget budget priorities for materials activities in each of the Federal departments and agencies;

(3) to review and appraise the various programs and activities of the Federal Government in accordance with the policy and directions given in the National Materials and Minerals Policy, Research and Development Act of 1980 (30 U.S.C. 1601), and to determine the extent to which such programs and activities are contributing to the achievement of such policy and directions;

(4) to monitor and evaluate the critical materials needs of basic and advanced technology industries and the Government, including the critical materials research and development needs of the private and public sectors;

(5) to advise the President of mineral and material trends, both domestic and foreign, the implications thereof for the United States and world economies and the national security, and the probable effects of such trends on domestic industries;

(6) to assess through consultation with the materials academic community the adequacy and quality of materials-related educational institutions and the supply of materials scientists and engineers;

(7) to make or furnish such studies, analyses, reports, and recommendations with respect to matters of materials-related policy and legislation as the President may request;

Report (8)(A) to prepare a report providing a domestic inventory of critical materials with projections on the prospective needs of Government and industry for these materials, including a long-range assessment, prepared in conjunction with the Office of

Science and Technology Policy in accordance with the National Materials and Minerals Policy, Research and Development Act of 1980, and in conjunction with such other Government departments or agencies as may be considered necessary, of the prospective major critical materials problems which the United States is likely to confront in the immediate years ahead and providing advice as to how these problems may best be addressed, with the first such report being due on April 1, 1985, and (B) review and update such report and assessment as appropriate and report thereon to the Congress at least biennially; and

30 USC 1601 note.

(9) to recommend to the Congress such changes in current policies, activities, and regulations of the Federal Government, and such legislation, as may be considered necessary to carry out the intent of this title and the National Materials and Minerals Policy, Research and Development Act of 1980.

(b) In carrying out its responsibilities under this section the Council shall have the authority—

Advisory panels and interagency committees.

(1) to establish such special advisory panels as it considers necessary, with each such panel consisting of representatives of industry, academia, and other members of the private sector, not to exceed ten members, and being limited in scope of subject and duration; and

(2) to establish and convene such Federal interagency committees as it considers necessary in carrying out the intent of this title.

(c) In seeking to achieve the goals of this title and related Acts, the Council and other Federal departments and agencies with responsibilities or jurisdiction related to materials or materials policy, including the National Security Council, the Council on Environmental Quality, the Office of Management and Budget, and the Office of Science and Technology Policy, shall work collaboratively and in close cooperation.

PROGRAM AND POLICY FOR ADVANCED MATERIALS RESEARCH AND TECHNOLOGY

SEC. 205. (a) In addition to the responsibilities described in section 204, the Council shall be responsible for coordination with appropriate agencies and departments of the Federal Government relative to Federal materials research and development policies and programs. Such policies and programs shall be consistent with the policies and goals described in the National Materials and Minerals Policy, Research and Development Act of 1980. In carrying out this responsibility the Council shall—

30 USC 1604.

(1)(A) establish a national Federal program plan for advanced materials research and development, recommend the designation of the key responsibilities for carrying out such research, and to provide for coordination of this plan with the Office of Science and Technology Policy, the Office of Management and Budget, and such other Federal offices and agencies as may be deemed appropriate, and (B) annually review such plan and report thereon to the Congress;

(2) review annually the materials research, development, and technology authorization requests and budgets of all Federal agencies and departments; and in this activity the Council shall make recommendations, in cooperation with the Office of Sci-

ence and Technology Policy, the Office of Management and Budget, and all other Federal offices and agencies deemed appropriate, to ensure close coordination of the goals and directions of such programs with the policies determined by the Council; and

(3) assist the Office of Science and Technology Policy in the preparation of such long-range materials assessments and reports as may be required by the National Materials and Minerals Policy, Research and Development Act of 1980, and assist other Federal entities in the preparation of analyses and reporting relating to critical and advanced materials.

30 USC 1601 note

(b) The Office of Management and Budget, in reviewing the materials research, development, and technology authorization requests of the various Federal departments and agencies for any fiscal year, and the recommendations of the Council, shall consider all of such requests and recommendations as an integrated, coherent, multiagency request which shall be reviewed by the Office of Management and Budget for its adherence to the national Federal materials program plan in effect for such fiscal year under subsection (a).

INNOVATION IN BASIC AND ADVANCED MATERIALS INDUSTRIES

Centers for Industrial Technology. 30 USC 1805.

SEC. 206. (a)(1) In order to promote the use of more cost-effective, advanced technology and other means of providing for innovation and increased productivity within the basic and advanced materials industries, the Council shall evaluate and make recommendations regarding the establishment of Centers for Industrial Technology as provided in Public Law 96-480 (15 U.S.C. 3705).

(2) The activities of such Centers shall focus on, but not be limited to, the following generic materials areas: corrosion; welding and joining of materials; advanced processing and fabrication technologies; microfabrication; and fracture and fatigue.

(b) In order to promote better use and innovation of materials in design for improved safety or efficiency, the Council shall establish in cooperation with the appropriate Federal agencies and private industry, an effective mechanism for disseminating materials property data in an efficient and timely manner. In carrying out this responsibility, the Council shall consider, where appropriate, the establishment of a computerized system taking into account, to the maximum extent practicable, existing available resources.

COMPENSATION OF MEMBERS AND REIMBURSEMENTS

30 USC 1806.

SEC. 207. (a) The Chairman of the Council, if not otherwise a paid officer or employee of the Federal Government, shall be paid at the rate not to exceed the rate of basic pay provided for level II of the Executive Schedule. The other members of the Council, if not otherwise paid officers or employees of the Federal Government, shall be paid at a per diem rate comparable to the rate not to exceed the rate of basic pay provided for level III of the Executive Schedule.

(b) Subject to existing law and regulations governing conflicts of interest, the Council may accept reimbursement from any private nonprofit organization or from any department, agency, or instrumentality of the Federal Government, or from any State or local government, for reasonable travel expenses incurred by any member or employee of the Council in connection with such member's or employee's attendance at any conference, seminar, or similar meeting.

POSITION AND AUTHORITIES OF EXECUTIVE DIRECTOR

SEC. 208. (a) There shall be an Executive Director (hereinafter referred to as the "Director"), who shall be chief administrator of the Council. The Director shall be appointed by the Council full time and shall be paid at the rate not to exceed the rate of basic pay provided for level III of the Executive Schedule. 30 USC 1807

(b) The Director is authorized—

(1) to employ such personnel as may be necessary for the Council to carry out its duties and functions under this title, but not to exceed twelve compensated employees;

(2) to obtain the services of experts and consultants in accordance with the provisions of section 3109 of title 5, United States Code; and

(3) to develop, subject to approval by the Council, rules and regulations necessary to carry out the purposes of this title.

(c) In exercising his responsibilities and duties under this title, the Director—

(1) may consult with representatives of academia, industry, labor, State and local governments, and other groups; and

(2) shall utilize to the fullest extent possible the services, facilities, and information (including statistical information) of public and private agencies, organizations, and individuals.

(d) Notwithstanding section 3679(b) of the Revised Statutes (31 U.S.C. 665(b)), the Council may utilize voluntary and uncompensated labor and services in carrying out its duties and functions. 31 USC 1342

RESPONSIBILITIES AND DUTIES OF THE DIRECTOR

SEC. 209. In carrying out his functions the Director shall assist and advise the Council on policies and programs of the Federal Government affecting critical and advanced materials by— 30 USC 1808

(1) providing the professional and administrative staff and support for the Council;

(2) assisting the Federal agencies and departments in appraising the effectiveness of existing and proposed facilities, programs, policies, and activities of the Federal Government, including research and development, which affect critical materials availability and needs;

(3) cataloging, as fully as possible, research and development activities of the Government, private industry, and public and private institutions; and

(4) initiating Government and private studies and analyses, including those to be conducted by or under the auspices of the Council, designed to advance knowledge of critical or advanced materials issues and develop alternative proposals, including research and development, to resolve national critical materials problems.

AUTHORITY

SEC. 210. The Council is authorized— 30 USC 1809

(1) to establish such internal rules and regulations as may be necessary for its operation; Regulations.

Contracts with U.S. (2) to enter into contracts and acquire materials and supplies necessary for its operation to such extent or in such amounts as are provided for in appropriation Acts;

Public information (3) to publish, consistent with title 44 of the United States Code, or arrange to publish critical materials information that it deems to be useful to the public and private industry to the extent that such publication is consistent with the national defense and economic interest;

(4) to utilize such services or personnel as may be provided to the Council on a reimbursable basis by any agency of the United States; and

(5) to exercise such authorities as may be necessary and incidental to carrying out its responsibilities and duties under this title.

AUTHORIZATION OF APPROPRIATIONS

30 USC 1810. SEC. 211. There are hereby authorized to be appropriated to carry out the provisions of this title a sum not to exceed $500,000 for the fiscal year ending September 30, 1985, and such sums as may be necessary thereafter: *Provided*, That the authority provided for in this title shall expire on September 30, 1990, unless otherwise authorized by Congress.

DEFINITION

30 USC 1811. SEC. 212. As used in this title, the term "materials" has the meaning given it by section 2(b) of the National Materials and
30 USC 1601. Minerals Policy, Research and Development Act of 1980.

Approved July 31, 1984.

LEGISLATIVE HISTORY—S. 373:

HOUSE REPORTS: No. 98-583, Pt. 1 (Comm. on Science and Technology) and Pt. 2 (Comm. on Merchant Marine and Fisheries).
SENATE REPORT No. 98-159 (Comm. on Governmental Affairs).
CONGRESSIONAL RECORD:
Vol. 129 (1983): June 27, considered and passed Senate.
Vol. 130 (1984): Apr. 24, considered and passed House, amended.
June 21, Senate concurred in House amendments with amendment.
June 26, House concurred in Senate amendments.

○

Appendix II
Conference Participants

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Arctic Science Policy and Development Conference
29-30 October 1985
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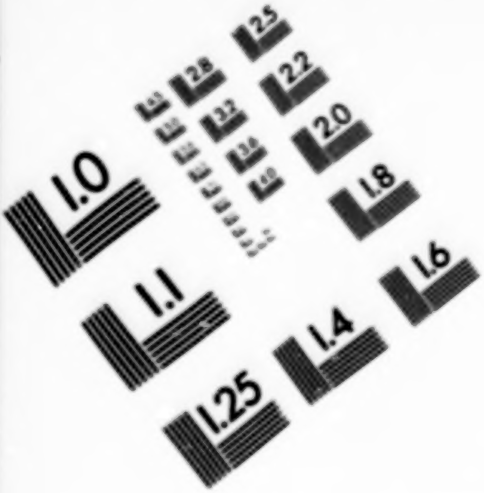

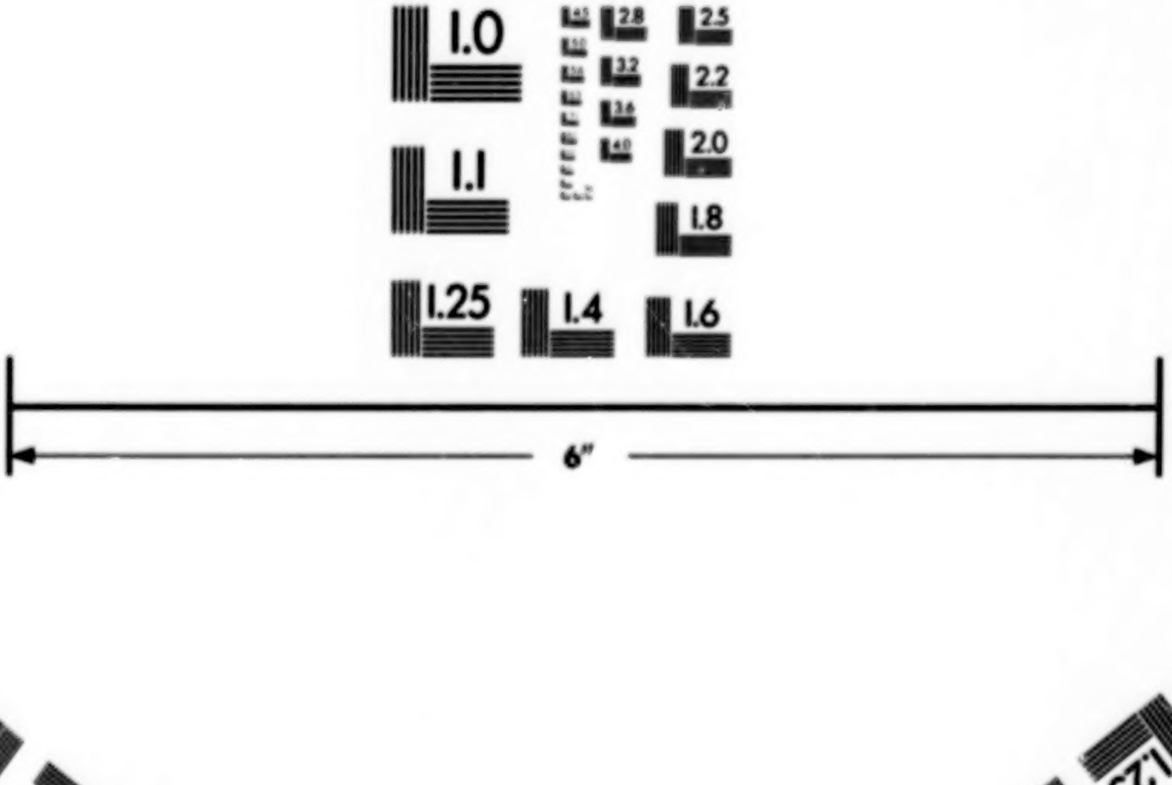

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